

Observatory

PROJECT MANUAL

Rancho Mirage Observatory Project (CP 15-315)
71-100 Highway 111
Rancho Mirage, CA 92270

Narkweather Architects Inc.

73 330 Highway 111, Suite A
Palm Desert, CA 92260-4016

Project Specifications

CITY PROJECT NO. CP15-315

AUGUST 2016

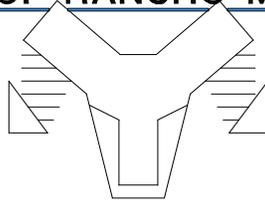
00 01 07 – SEALS PAGE

I hereby certify that the Project Drawings and the Project Manual were prepared by me or under my direct supervision and that I am duly licensed as an architect under the Laws and regulations of the State of California.

Narkweather Architects Inc.

Charles Martin - Architect
 17 AUG 2016

CITY OF RANCHO MIRAGE



CONTRACT DOCUMENTS AND SPECIFICATIONS

FOR

Rancho Mirage Observatory Project

PROJECT NO. CP15-315

Prepared by:

Narkweather Architects Inc.

73 330 Highway 111, Suite A
Palm Desert, CA 92260-4016

August 2016

**CITY OF RANCHO MIRAGE
CALIFORNIA**

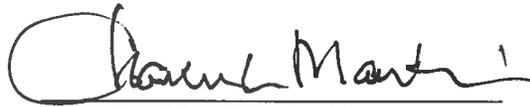
CONTRACT DOCUMENTS AND SPECIFICATIONS

FOR

RANCHO MIRAGE OBSERVATORY PROJECT

PROJECT NO. CP15-315

Prepared Under the Supervision of:

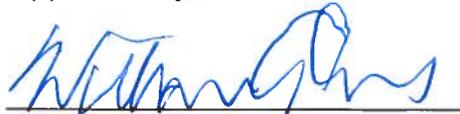


Charles Martin - Architect
Narkweather Architects Inc.
California Lic. # C7562



Date:

Approved by:



William A. Enos, City Engineer
R.C.E. 43910



Date:

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**00 0201 NOTICE INVITING SEALED BIDS FOR
RANCHO MIRAGE OBSERVATORY
CITY PROJECT NO. CP15-315**

PUBLIC NOTICE IS HEREBY GIVEN that the City of Rancho Mirage, hereinafter referred to as CITY, invites sealed bids for the above-stated project and will receive such bids in the offices of the City Engineer up to the hour of 4:00 P.M. (P.D.T.), on September 27, 2016 at which time they will be publicly opened and read aloud.

The work to be done consists of furnishing all materials, equipment, tools, labor, and incidentals as required by the Plans, Specifications and Contract Documents for the above-stated project. The general items of work to be done hereunder consists of constructing a new building, specialty equipment, ramps, exhibit deck, utility connections, landscaping, pathways connecting existing facilities, and all other work necessary to complete project per the project plans and specifications.

Plans and Specifications are available; to be provided at city hall located at 69825 Highway 111, Rancho Mirage, California.

A pre-qualification process was required for this project. Bidders must be on list of City-approved pre-qualified general contractors to bid on the work.

Any contract entered into pursuant to this notice will incorporate the provisions of the State Labor Code. Compliance with the prevailing rates of wages and apprenticeship employment standards established by the State Department of Industrial Relations will be required.

No bidders will be discriminated against on the basis of race, color, national origin, ancestry, sex, or religion in any consideration leading to the award of contract.

The contract documents call for monthly progress payments based upon the engineers' estimate of the percentage of work completed. The CITY will retain 5 percent of each progress payment as security for completion of the balance of the work. At the request and expense of the successful bidder, the City will pay the amounts so retained upon compliance with the requirements of Public Contract Code, Part 5, Section 22300 and the provisions of the contract documents pertaining to Substitution of Securities.

Bids must be prepared on the approved proposal forms in conformance with the Instructions to Bidders and submitted in a sealed envelope plainly marked on the outside "SEALED BID FOR OBSERVATORY PROJECT, CP 15-315 - DO NOT OPEN WITH REGULAR MAIL." City staff will not be available to respond to questions on the day of bid opening.

The CITY reserves the right to reject any or all bids, to waive any irregularity, to accept any bid or portion thereof, and to take all bids under advisement for a period of sixty (60) days.

At the time of contract award, the prime contractor shall possess a valid Class B contractor's license and/or a combination of Class "C" specialty contractor's license(s) sufficient to perform the work.

Only bids from contractors that were deemed prequalified during the prequalification phase held earlier this year and submitted by contractors who received notice from the City of such prequalification status will be considered.

BY ORDER OF the City Council of the City of Rancho Mirage.

For further information, please contact the Public Works Department at (760) 770-3224.

August 18, 2016

00 10 01 INSTRUCTIONS TO BIDDERS

PROPOSAL FORMS

Bids shall be submitted in writing on the Proposal forms provided by the CITY. All information requested therein must be clearly and legibly set forth in the manner and form indicated. The CITY will not consider any proposal not meeting these requirements.

NOTICE REGARDING REGISTRATION WITH DEPARTMENT OF INDUSTRIAL RELATIONS

No contractor or subcontractor may be listed on a bid proposal for public works project (submitted on or after March 1, 2015) unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5 (with limited exceptions from this requirement for bid purposes only under Labor Code section 1771.1(a)). No contractor or subcontractor may be awarded a contract for public work on a public works project (awarded on or after April 1, 2015) unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5. This project is subject to compliance monitoring and enforcement by the Department of Industrial Relations.

PROPOSAL GUARANTEE (BID BOND)

Proposals must be accompanied by a proposal guarantee consisting of a certified check or bid bond payable to the CITY in the amount of ten percent (10%) of the total amount bid. Any proposal not accompanied by such a guarantee will not be considered. If a bidder to whom a contract is awarded fails or refuses to execute the contract documents or furnish the required insurance policies and bonds as set forth in those documents, the proposal guarantee shall be forfeited to the CITY. The proposal guarantees of all bidders will be held until the successful bidder has properly executed all contract documents.

NONCOLLUSION AFFIDAVIT

Bidder shall declare that the only persons or parties interested in the proposal as principals are those named therein; that no officer, agent, or employee of the CITY is personally interested, directly or indirectly, in the proposal; that the proposal is made without connection to any other individual, firm, or corporation making a bid for the same work; and that the proposal is in all respects fair and without collusion or fraud. The Noncollusion Affidavit shall be executed and submitted with the proposal.

PROPOSAL BID SHEET

Bidders shall give unit prices for each and all of the items set forth. No aggregate bids shall be considered. The bidder shall set forth for each item of work, in clearly legible figures, a unit item price and a total for the item in the respective spaces provided for this purpose. The quantities listed in the Bid sheets are supplied to give an indication of the general scope of work, but the accuracy of figures is not guaranteed and the bidder shall make his/her own estimates from the drawings. In case of a variation between the unit price and the totals shown by the bidder, the unit price shall be considered to be the bid.

DELIVERY OF PROPOSAL

Proposals may be mailed or delivered by messenger to City of Rancho Mirage Public Works, 69-825 Highway 111, Rancho Mirage, CA 92270. However, it is the bidder's responsibility alone to ensure delivery of the proposal to the hands of the CITY'S designated official prior to the bid opening hour stipulated in the "Notice Inviting Sealed Bids." Late proposals will not be considered. Proposals shall be enclosed in a sealed envelope plainly marked on the outside, "SEALED BID FOR OBSERVATORY PROJECT, CP 15-315 - DO NOT OPEN WITH REGULAR MAIL."

WITHDRAWAL OF PROPOSALS

A proposal may be withdrawn by a written request signed by the bidder. Such requests must be delivered to the CITY'S designated official prior to the bid opening hour stipulated in the "Notice Inviting Sealed Bids." The withdrawal of a proposal will not prejudice the right of the bidder to submit a new proposal, providing there is time to do so. Proposals may not be withdrawn after said hour without forfeiture of the proposal guarantee.

IRREGULAR PROPOSALS

Unauthorized conditions, limitations, or provisions attached to a proposal will render it irregular and may cause its rejection. The completed proposal forms shall be without interlineations, alterations, or erasures. Alternative proposals will not be considered unless specifically requested. No oral, telegraphic, or telephonic proposal, modification, or withdrawal will be considered.

TAXES

No mention shall be made in the proposal of Sales Tax, Use Tax, or any other tax, as all amounts bid will be deemed and held to include any such taxes that may be applicable.

DISQUALIFICATION OF BIDDERS

In the event that any bidder acting as a prime contractor has an interest in more than one proposal, all such proposals shall be rejected, and the bidder disqualified. This restriction does not apply to subcontractors or suppliers who may submit quotations to more than one bidder, and while doing so, may also submit a formal proposal as a prime contractor.

No contract will be executed unless the bidder is licensed in accordance with the provisions of the State Business and Professions Code.

INTERPRETATION OF PLANS AND DOCUMENTS

If any person contemplates submission of a bid for the proposed contract and is in doubt as to the true meaning of any part of the plans, specifications or other proposed contract documents, or finds discrepancies in, or omissions from, the drawings or specifications, he may submit to the Engineer of said CITY a written request for an interpretation or correction thereof. The person submitting the request shall be responsible for its prompt delivery. Any interpretation or correction of the proposed documents shall be made only by addendum duly issued and copy of such addendum shall be mailed or delivered to each person receiving a set of such documents. The Engineer will not be responsible for any other explanation or interpretations of the proposed documents.

ADDENDA OR BULLETINS

The effect of all addenda to the Contract Documents shall be considered in the contract, and said addenda shall be made a part of the contract documents and shall be returned with them. Before submitting his/her bid, each bidder shall inform himself as to whether or not any addenda have been issued, and failure to cover in this bid any such addenda issued may render his/her bid irregular and may result in its rejection by the City.

LEGAL RESPONSIBILITIES

All proposals must be submitted, filed, made, and executed in accordance with State and Federal laws relating to bids for contracts of this nature whether the same or expressly referred to herein or not.

Any bidder submitting a proposal shall by such action thereby agree to each and all of the terms, conditions, provisions, and requirements set forth, contemplated, and referred to in the Plans, Specifications, and Contract Documents, and to full compliance therewith.

AWARD OF CONTRACT

Following a review of the bids, the CITY shall determine whether to award the contract or to reject all bids. The award of contract, if made, shall be to the lowest responsible Bidder as determined solely by the CITY. At the time of contract award, the successful bidder shall hold a Class B contractor's license and/or a combination of Class C specialty contractor's licenses, as required to perform the work, issued by the State of California. Additionally, the CITY reserves the right to reject any or all proposals, to accept any bid or portion thereof, to waive any irregularity, and to take the bids under advisement for the period of time stated in the "Notice Inviting Sealed Bids," all as may be required to provide for the best interests of the CITY. In no event will an award be made until all necessary investigations are made as to the responsibility and qualifications of the bidder to whom the award is contemplated.

No bidder may withdraw his/her proposal for a period of sixty (60) days after the time set for opening thereof. However, the CITY will return all proposal guarantees within ten (10) days after the award of the contract or rejection of the bids, as the case may be, to the respective bidders whose proposals they accompany.

LABOR CODE

Pursuant to the provisions of Section 1773 and 1773.2 of the Labor Code of the State of California, the CITY has obtained the general provisions rate of per diem wages and the general prevailing rate for holiday and overtime work in this locality for each craft, classification or type of workman needed to execute the contract from the director of the Department of Industrial Relations. These rates are on file with the Clerk of the CITY, and copies will be made available to any interested party on request. It shall be the responsibility of the prime CONTRACTOR to comply with all applicable sections of the Labor Code.

The CONTRACTOR shall comply with the provisions of Section 1774 of the Labor Code. Failure to comply with the subject section will subject the CONTRACTOR to penalty and forfeiture provisions of Section 1775 of the Labor Code.

Pursuant to the provisions of Section 1770 of the Labor Code, the general prevailing rate of wages has been ascertained (which rate includes employer payments for health and welfare, vacation, pension and similar purposes) applicable to the work to be done, for straight time, overtime, Saturday, Sunday, and holiday work. The holiday wage rate listed shall be applicable to all holidays recognized in the collective bargaining agreement of the particular craft, classification or type of workmen concerned.

The CITY will not recognize any claim for additional compensation because of the payment by the CONTRACTOR of any wage rate in excess of the prevailing wage rate set forth in the contract. The possibility of wage increases is one of the elements to be considered by the CONTRACTOR in determining his bid, and will not under any circumstances be considered as the basis of a claim against the CITY on the contract.

The CONTRACTOR shall comply with Section 1777.5 of the Labor Code, which allows the employment of properly registered apprentices on public works projects. The CONTRACTOR is responsible for the compliance with this section for all apprentice able occupations and subcontractors.

The CONTRACTOR and subcontractors shall comply with all State of California laws against employment discrimination.

WORKERS COMPENSATION CERTIFICATE

Section 3700 of the State Labor Code requires that every employer shall secure the payment compensation by either being insured against liability to pay compensation with one or more insurers or by securing a Certificate of Consent to Self-Insure from the State of California Director of Industrial Relations.

CLAYTON ACT AND CARTWRIGHT ACT

Section 4551 of the State Government Code specifies that in executing a public works contract with the City to supply goods, services or materials, the CONTRACTOR or Subcontractor offers and agrees to assign to the CITY all rights, title and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Sec. 15) or under the Cartwright Act (Chapter 2 commencing with Sec. 16700) of Part 2 of Division 7 of the Business and Professions Code, arising from purchase of goods, services or materials pursuant to the contract or subcontract. This assignment shall become effective when the CITY tenders final payment to the CONTRACTOR without further acknowledgment by the parties.

SUBSTITUTION OF SECURITIES

In conformance with the State of California Public Contract Code, Part 5, Section 22300, the CONTRACTOR may substitute securities for any monies withheld by the CITY to ensure performance under the contract.

At the request and expense of the CONTRACTOR, the CONTRACTOR has the option to set up an escrow agreement account with a local bank for direct deposit of the retention or deposit securities which have been approved by the CITY and deposited with a state or federally chartered bank as the escrow agent. Said securities will be used as a substitute for retention earnings required to be withheld by the CITY, pursuant to the construction contract. Said securities shall be solely for this project. When the CONTRACTOR deposits the

CITY-approved securities with the escrow agent, the escrow agent shall notify the CITY within 10 calendar days of the deposit. Said securities shall be evaluated quarterly by the escrow agent to verify the current market value. If the current market value of said securities falls below the required amount, the escrow agent shall notify the CONTRACTOR and require additional securities and/or cash be submitted for CITY approval and be held in the escrow account to meet the CONTRACTOR'S obligations. Said securities shall be held by the escrow agent until such time as the escrow agent receives written notification from the CITY that the CONTRACTOR has satisfactorily completed his/her contract obligations.

The type of escrow account or types of securities deposited and the method of release shall be approved by the City Attorney's office.

00 31 01 BID PROPOSAL

BIDDER'S NAME _____

TO CITY OF RANCHO MIRAGE, as CITY:

In accordance with CITY'S "Notice Inviting Sealed Bids", the undersigned BIDDER hereby proposes to furnish all materials, equipment, tools, labor, and incidentals required for the above-stated project as set forth in the Plans, Specifications, and Contract Documents therefore, and to perform all work in the manner and time prescribed therein.

BIDDER declares that this proposal is based upon careful examination of the work site, Plans, Specifications, Instructions to Bidders, and Contract Documents. If this proposal is accepted for award, BIDDER agrees to enter into a contract with CITY at the unit and/or lump sum prices set forth in the following Proposal Bid Sheets. BIDDER understands that failure to enter into a contract in the manner and time prescribed will result in forfeiture to CITY of the Bid Bond accompanying this proposal.

BIDDER understands that a bid is required for the entire work that the estimated quantities set forth in the Proposal Bid Sheet are solely for the purpose of comparing bids, and that final compensation under the contract will be based upon the actual quantities of work satisfactorily completed. It is agreed that the unit and/or lump sum prices bid include all appurtenant expenses, taxes, royalties, and fees. In the case of discrepancies in the amounts bid, unit prices shall govern over extended amounts.

BIDDER agrees and acknowledges that he is aware of the provisions of Section 3700 of the Labor Code which requires that every employer be insured against liability for workers compensation or to undertake self-insurance in accordance with the provisions of that code, and that the successful BIDDER shall comply with such provisions of that code before commencing the performance of the Contract.

BIDDER certifies that in all previous contracts or subcontracts, all reports that may have been due under the requirements of any agency, state, or federal equal employment opportunity orders have been satisfactorily filed, and that no such reports are currently outstanding.

BIDDER declares that the only persons or parties interested in this proposal as principals are those named herein; that no officer, agent, or employee of the CITY is personally interested, directly or indirectly, in this proposal; that this proposal is made without connection to any other individual, firm, or corporation making a bid for the same work; and that this proposal is in all respects fair and without collusion or fraud.

DATED _____, 20__

BIDDER _____

(BY) _____

TITLE _____

BIDDER'S ADDRESS:

PHONE: _____

FAX: _____

BIDDER'S INFORMATION

BIDDER certifies that the following information is true and correct.

Bidder's Name _____

Business Address _____

Telephone _____

State Contractor's License No. and Class _____

Original Date Issued _____ Expiration Date _____

DIR # _____

The following are the names, titles, addresses, and phone numbers of all individuals, firm members, partners, joint ventures, and/or corporate officers having a principal interest in this proposal:

The dates of any voluntary or involuntary bankruptcy judgments against any principal having an interest in this proposal are as follows:

All current and prior dbas, aliases, and/or fictitious business names for any principal having an interest in this proposal are as follows.

00 31 05 BID BOND

KNOW ALL MEN BY THESE PRESENTS that _____, as BIDDER, and _____, as SURETY, are held and firmly bound unto the CITY OF RANCHO MIRAGE, as AGENCY, in the penal sum of _____ dollars (\$_____), which is ten percent (10%) of the total amount bid by BIDDER to AGENCY for the above-stated project, for the payment of which sum BIDDER and SURETY agree to be bound jointly, severally and firmly by these presents.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH that, whereas BIDDER is about to submit a bid to AGENCY for the above-stated project, if said bid is rejected, or if said bid is accepted and a contract is awarded and entered into by BIDDER in the manner and time specified, then this obligation shall be null and void; otherwise, it shall remain in full force and effect in favor of AGENCY.

WITNESS our hands this _____ day of _____, 20___. (seal)

CONTRACTOR (CORPORATION) -TYPE

By: _____
President

By: _____
Secretary/Treasurer

NOTE: SIGNATURE OF CORPORATE OFFICIALS MUST BE NOTARIZED.

(seal)

SURETY'S NAME-TYPE

Mailing Address

By: _____
Name

Title

NOTE: SIGNATURE OF SURETY MUST BE NOTARIZED

00 31 07 NON-COLLUSION AFFIDAVIT

STATE OF CALIFORNIA)

)

COUNTY OF)

_____, being first duly sworn, deposes and says that he is (sole owner, a partner, president, etc.) of _____ the party making the foregoing bid;

That such bid is not made in the interest of or on behalf of any undisclosed person, partnership, company, association, organization or corporation; that such bid is genuine and not a collusive or sham bid, or that anyone shall refrain from bidding; that said bidder has not in any manner, directly or indirectly, sought by agreements, communication or conference with anyone to fix the bid price of said bidder or of any other bidder, or to fix the overhead, profit, or cost element of such bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract or anyone interested in the proposed contract; that all statements contained in such bid are true, and further, that said bidder has not, directly or indirectly submitted his/her bid price, or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid and will not pay any fee in connection, organization, bid depository, or to any member or persons as have a partnership or other financial interest with said bidder in his/her general business.

Signed: _____

Title: _____

**RANCHO MIRAGE OBSERVATORY
PROJECT NO. CP15-315**

00 31 08 BID PROPOSAL SHEET

Note: The bidding contractor shall break down and list major construction categories below. Exclude from contract bid the owner-supplied Telescope (Planewave 700) and the Observatory Dome (Ash Manufacturing). After delivery to site, the contract stipulates all labor, equipment, and devices for installation are the responsibility of the General contractor.

ITEM NO.

DESCRIPTION

- 1 Permits for construction - Public Works and Building & Safety
- 2 Mobilization
- 3 Barriers and fencing
- 4 Clearing and grubbing
- 5 Existing irrigation reroute
- 6 Grading
- 7 Substructure:
 - a. Electrical
 - b. Data feed to Library building
 - c. Sewer lateral and connection
 - d. Water lateral and connection
- 8 Footings / Foundation
- 9 Building structure (rough)
- 10 Building electrical
- 11 Building plumbing
- 12 Building mechanical HVAC
- 13 Fire Suppression System
- 14 Decking
- 15 Walkways
- 16 Landscape irrigation
- 17 Landscape planting
- 18 Slurry and striping
- 19 Dome assembly, installation, and testing – per manufacturer’s instructions and supervision
- 20 Telescope installation and testing – per manufacturer’s instructions and supervision
- 21 Computerized instrumenting, including remote operations and ensuring telescope and dome positioning is synchronized with each other.
- 22 System testing / adjusting
- 23 All work necessary to complete project per plans, specifications, and manufacturers’ instructions

TOTAL BID AMOUNT (all listed items)

\$

TOTAL BID AMOUNT IN WORDS

By signing below the bidder acknowledges their understanding of the scope of work and that bidder has read, understands, and agrees to the terms and conditions of the project documents and all of the attachments and addenda.

AUTHORIZED SIGNATURE:

PRINT SIGNER'S NAME AND TITLE:

DATE SIGNED:

COMPANY NAME, ADDRESS, TELEPHONE:

00 31 21 STANDARD AGREEMENT FOR PUBLIC WORKS CONSTRUCTION

The CITY OF RANCHO MIRAGE (“CITY”) and _____ (“CONTRACTOR”), through this agreement (“Agreement”), agree as follows:

- A. CONTRACTOR shall construct the following public improvements ("work") identified as:
Construction of a new building, specialty equipment, ramps, exhibit deck, utility connections, landscaping, pathways connecting existing facilities, installation of telescope, assembly and installation of dome, installation of computers, testing of entire facility, and all work necessary to complete the project per the project plans, specifications, and manufacturers' instructions.
- B. CITY-approved plans and specifications for the construction of the work, which are incorporated herein by reference and prepared by:
See attachments to specifications
- C. The following are attached hereto and made a part hereof and/or are incorporated by reference: Schedule A, Notice Inviting Sealed Bids, Instructions to Bidders, Proposal Documents, General Conditions, Special Provisions, Plans and Specifications, and all referenced specifications, details, standard drawings and appendices, together with this Agreement and all required bonds, insurance certificates, permits, notices and affidavits; and also including any and all addenda or supplemental agreements clarifying, amending or extending the work contemplated as may be required to ensure its completion in an acceptable manner.
- 1. **COMPENSATION:** For and in consideration of the payments to be made and by CITY, CONTRACTOR agrees to furnish all materials and perform all work required for the work, and to fulfill all other obligations as set forth herein.

CONTRACTOR agrees to receive and accept the prices set forth in the Proposal as full compensation for furnishing all materials, performing all work, and fulfilling all obligations hereunder. Said compensation shall cover all expenses, losses, damage and consequences arising out of the nature of work during its progress or prior to its acceptance, including those for well and faithfully completing the work and the whole thereof in the manner and time specified herein; and also including those arising from actions of the elements, unforeseen difficulties or obstructions encountered in the prosecution of the work, suspension or discontinuance of the work and all other unknowns or risks of any description connected with the work.

CITY hereby promises and agrees to retain, and does hereby retain, CONTRACTOR to provide the materials, do the work, and fulfill the obligations according to the terms and conditions herein contained and referred to, for prices aforesaid, and hereby contracts to pay the same at the time, in the manner and upon the conditions set forth herein.

Monthly progress payments shall be made by the CITY based upon the City Engineer’s estimate of the percentage of work completed. The CITY will retain five (5) percent of each progress payment as security for completion of the balance of the work, in accordance with Section 9203 of the Public Contract Code. The retention shall be released in accordance with applicable law.

2. IMPROVEMENTS: For valuable consideration, CONTRACTOR agrees to do, or cause to be done, all of the work described herein by the date specified in Schedule A. CONTRACTOR warrants that all of the materials supplied and work to be done will be of good quality and workmanship. Said work shall be in strict conformity with the plans and specifications of the work, the standard specifications and drawings for public improvements adopted by CITY and this Agreement. CONTRACTOR shall furnish all transportation, equipment, labor, services, permits, utilities and all other items necessary to complete the work. CONTRACTOR shall pay all claims, demands and liability arising out of, or resulting from or in connection with, the performance of the work. CONTRACTOR shall furnish accurate "as constructed" plans. CONTRACTOR'S obligations herein are not limited by any cost estimates nor will any estimate be a measure of damages.

3. TIME FOR COMPLETION: The work shall be commenced on a date to be specified in a written Notice to Proceed from CITY and shall be completed within **280** calendar days from and after said date. It is expressly agreed that except for extensions of time duly granted in the manner and for the reasons specified in the General Provisions, time shall be of the essence.

4. INSURANCE: CONTRACTOR shall not commence or continue to perform any work unless CONTRACTOR has in full force and effect all insurance required hereunder with companies satisfactory to CITY. To be acceptable, insurers must be authorized to do business, and have an agent for service of process, in California, and have an "A" policyholder's rating and a financial rating of at least Class V, in accordance with the current Best's Ratings. All insurance policies shall be maintained until the work is accepted by CITY and provide for coverage of all causes of action or disputes arising out of acts in performance of the construction of the work herein, whether said causes or disputes are filed or brought to the attention of CITY before or after the termination of this Agreement.

Concurrent with execution of this Agreement, CONTRACTOR shall provide certificate(s) of insurance and endorsements, satisfactory to CITY, or otherwise provide proof of insurance as approved by the City Attorney, certifying that CONTRACTOR has and will maintain for the Agreement period, full worker's compensation insurance coverage as required by State laws, for all persons who are or may be employed in carrying out the work.

Concurrent with execution of this Agreement, CONTRACTOR shall provide to CITY certificate(s) of insurance and endorsements, satisfactory to CITY, or otherwise provide proof of insurance as approved by the City Attorney, certifying that CONTRACTOR has general liability and commercial vehicle liability insurance coverage naming CITY, City Council members, CITY'S engineer, and their consultants, officials, directors, officers, agents and employees, as additional insureds for both bodily injury and property damage of not less than that specified in Schedule A.

General liability and commercial vehicle liability insurance coverage shall include each of the following types of insurance as required by CITY to carry out this Agreement:

- | | |
|--|---|
| <p>A. General Liability</p> <ol style="list-style-type: none"> 1. Comprehensive Form 2. Premises-Operations 3. Explosion and Collapse Hazard 4. Underground Hazard 5. Products/Completed Operations Hazard 6. Contract Insurance 7. Broad Form Property Damage including Completed Operations 8. Independent Contractors 9. Personal Injury | <p>B. Automobile Liability</p> <ol style="list-style-type: none"> 1. Comprehensive Form, Including Loading and Unloading 2. Owned 3. Hired 4. non-owned |
|--|---|

Concurrent with execution of any agreements between CONTRACTOR and any subcontractors retained by CONTRACTOR to perform any work required of CONTRACTOR

hereunder, and in any event prior to CONTRACTOR authorizing any subcontractors to perform any such work or to even conduct any preliminary activities in preparation for or in anticipation of such work, CONTRACTOR shall collect certificates of insurance from all such subcontractors evidencing proof that all subcontractors have procured and will maintain all the insurance coverages required of CONTRACTOR under this Agreement.

In addition to naming the CITY, City Council members, CITY'S engineer, and their consultants, officials, directors, officers, agents and employees, as additional insureds, as set forth above, the certificates of insurance, including those provided by any subcontractor, provided either on forms required by the CITY or as otherwise approved by the City Attorney, shall bear the following endorsements: (1) each policy required herein must be endorsed to provide that the policy shall not be cancelled or non-renewed by or reduced in coverage or limits (except by paid claims) unless the insurer has provided the CITY with thirty (30) days prior written notice of cancellation; (2) the carriers of all required insurance policies must waive all rights of subrogation against the CITY and its officers, employees, servants, volunteers, agents and independent contractors; and (3) except for worker's compensation insurance, all insurance policies required to be provided by CONTRACTOR must be endorsed to provide that the policies shall apply on a primary and noncontributing basis in relation to any insurance or self-insurance, primary or excess, maintained or available to the CITY, and its officers, employees, servants, volunteers, agents and independent contractors.

Nothing contained in these insurance requirements shall limit the liability of CONTRACTOR or CONTRACTOR's sureties. Review and acceptance of insurance certificates shall not constitute any representation by CITY or its representatives that any required insurance has been issued.

5. **CONTRACTOR'S LIABILITY:** CONTRACTOR shall, at CONTRACTOR'S sole cost and expense, be solely and completely responsible for all matters effecting the design, prosecution, progress and completion of the work (both on and off the job site). CONTRACTOR shall be responsible for observing all laws. CONTRACTOR shall provide for public convenience and safety and safety of workers, including CONTRACTOR'S workers and those of CONTRACTOR'S subcontractors, suppliers and others contributing to the work. CONTRACTOR shall protect CITY property and property rights of others, including the location, maintenance and replacement of utilities, whether shown on the plans or not. CONTRACTOR shall give prior notification to utility owners. CONTRACTOR shall notify Underground Service Alert at 1-800-422-4133 at least 48 hours prior to start of construction. CONTRACTOR shall protect against, and prevent drainage from, storm runoff. CONTRACTOR shall not interfere with easements, rights-of-way and encroachment permits. Nothing in this Agreement, the specifications, or other contract documents, or CITY'S approval of the plans and specifications or inspection of the work is intended to include CITY'S review, inspection, acknowledgment of or responsibility for any such matters. CITY, CITY COUNCIL members, ENGINEER, and their consultants and each of their officials, directors, officers, employees and agents shall have no responsibility or liability for the above.
6. **CONTRACTOR'S INDEMNIFICATION:** CONTRACTOR shall indemnify and hold harmless CITY, CITY COUNCIL members, ENGINEER, and their consultants and each of their officials, directors, officers, agents and employees from and against all liability, claims, damages, losses, expenses and other costs, including costs of defense and attorneys' fees arising out of or resulting from or in connection with all matters affecting the design or construction of the work, both on and off the job site, and during and after completion. This, provided any of the above is: (1) attributable to bodily injury, sickness, disease or death, or to injury to or destruction of property (other than the work itself) including the loss of use resulting therefrom, and (2) caused in whole or in part by any act or omission of CONTRACTOR, CONTRACTOR'S engineer, any subcontractor, any supplier, anyone directly or indirectly employed by any of them or anyone for whose acts or omissions any of them may be liable. All of this regardless of whether or not it is caused in part by any act or omission (active, passive

or comparative negligence included) of a party indemnified hereunder. Said indemnification and agreement to hold harmless shall extend to injuries to persons and damages to or taking of property resulting from all matters affecting the design or construction of said improvements or the diversion of waters or from all matters affecting the design or construction or maintenance of drainage systems, streets and other improvements. Acceptance of these improvements by CITY shall not constitute an assumption by CITY of any responsibility for such damage or taking. As to any and all claims against the indemnified parties by any employee of CONTRACTOR, any contractor, any subcontractor, any supplier, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnity obligations hereunder shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the CONTRACTOR, subcontractor, supplier or other person under workers' compensation acts, disability benefit acts or other employee acts.

CONTRACTOR shall also indemnify and hold harmless CITY, CITY COUNCIL members, ENGINEER, and their consultants, and each of their officials, directors, officers, employees and agents from and against all losses, expenses, damages (including damages to the work itself), attorneys' fees and other costs, including costs of defense, which any of them may incur both during and after completion with respect to any latent deficiency in all matters affecting the design, specifications, surveying, planning, supervision, observation or construction of the improvements referred to herein or any injury to a person or property, real or personal, as a result of any such latent portions of the work which CITY reasonably performed by CONTRACTOR or CONTRACTOR'S subcontractors, or suppliers or designed by their representatives. Provisions of this paragraph shall remain in effect ten (10) years following acceptance of improvements by the City. Nothing contained herein shall limit CITY'S remedies pursuant to Code of Civil Procedure, Section 337.15.

7. **SECURITY:** With the execution of this Agreement, unless otherwise indicated on Schedule A, CONTRACTOR shall furnish and deliver to CITY, at no expense to CITY, a payment bond and a performance bond. Each shall be in the amount of CITY-approved estimate specified on Schedule A. Bonds shall be furnished by surety companies satisfactory to CITY on the forms provided by CITY. No alterations or substitution of said forms shall be allowed. To be acceptable, surety companies must be authorized to do business and have an agent for service of process in California, be on the accredited list of the United States Treasury Department, and have an "A" policyholder's rating and a financial rating of Class V, or better, in accordance with the current Best's Rating. The bonds shall be limited to amounts acceptable to the Treasury Department.

None of the following shall in any way affect the obligations of any surety. Each surety waives notice thereof: (a) any change, extension of time, alteration or additions to the terms of the Agreement, or the work to be performed, or the plans and specifications therefor; (b) any matters unknown to surety which might affect surety's risk, except that CITY shall advise surety upon request of the following: (1) any written claims it receives from unpaid subcontractors or suppliers, (2) any written orders received from other public authorities charging violations of laws, ordinances or regulations, and (3) failure of CONTRACTOR to comply with any written notice to correct defective work. The obligations of CONTRACTOR shall not be limited by the amount of such bonds.

8. **TYPES/AMOUNT OF SECURITY:** If specified in Schedule A, in lieu of payment and performance bonds, CONTRACTOR may furnish CITY either cash, a Letter of Credit, or an Agreement of Deposit as security for performance. Said security shall be in an amount not less than 100% of the cost estimate and, in addition, for payment of those furnishing materials, labor or equipment in an amount not less than 100% of the cost estimate. Said security agreements shall be on forms furnished by CITY. No alterations or substitution of said forms shall be allowed. The obligations of CONTRACTOR shall not be limited by the amount of the

security required. No interest shall be paid CONTRACTOR on any cash deposit made pursuant to this paragraph.

9. **SUBSTITUTION OF SECURITIES:** In conformance with the State of California Public Contract Code, Part 5, Section 22300, CONTRACTOR may substitute securities for any monies withheld by the CITY to ensure performance under this Agreement.

At the request and expense of CONTRACTOR, CONTRACTOR has the option of establishing an escrow account with a state or federally chartered bank which shall serve as an escrow agent, for CONTRACTOR's direct deposit of securities as a substitute for retention earnings required to be withheld by the CITY. Upon CONTRACTOR's completion of its obligations hereunder, as evidenced by the CITY's acceptance of the work pursuant to Section 11 hereof, the escrow agent shall return the securities to CONTRACTOR. The escrow agent shall notify the CITY within ten (10) days after deposit of the securities. The market value of the securities at the time of the substitution shall be at least equal to the cash amount then required to be withheld as retention. Securities shall be held in the name of the CITY and shall designate CONTRACTOR as the beneficial owner. Alternatively, on written request of CONTRACTOR, the CITY shall make payments of the retention earnings directly to the escrow account.

10. **PARTIAL UTILIZATION:** Until all work has been completed and accepted by CITY and all other public authorities having jurisdiction, CONTRACTOR shall be responsible for the care and maintenance of, or any damage to, the work.

When the work or any portion of it is sufficiently complete to be utilized or placed into service, CITY shall have the right, upon written notification to CONTRACTOR, to utilize such portions of the work and to place the operable portions into service. With this notice and commencement of utilization or operation by CITY, CONTRACTOR shall be relieved of the duty of maintaining the portions so utilized or placed into operation. However, such use and operation shall not relieve CONTRACTOR of the full responsibility for completing the work in its entirety, for making good any defective work or materials, for protecting the work from damage, and for being responsible for damage and for the work as set forth herein. Nor shall such action by CITY be deemed completion and acceptance. Further, such action shall not relieve CONTRACTOR or CONTRACTOR'S sureties and insurers of the provisions hereof relating to indemnity and guarantees.

11. **ACCEPTANCE OF PROJECT - WARRANTY:** Acceptance of the work shall only be by action of the CITY COUNCIL. Neither the acceptance nor any prior inspections or failure to inspect shall constitute a waiver by CITY of any defects in the work. From and after acceptance, the work shall be owned and operated by CITY. As a condition to acceptance, CONTRACTOR shall certify to CITY in writing that all of the work has been performed in strict conformity with the Agreement and that all costs have been paid or supplied to CITY security, satisfactory to CITY, guaranteeing such performance. In addition to CONTRACTOR'S other obligations under the Agreement CONTRACTOR warrants all work and materials to be good quality and fit for the purpose and intended use. CONTRACTOR shall also repair, replace and restore any other work which is displaced in correcting defective work as well as other portions of the work which CITY by reason of such defects reasonably suspects may also be defective.

In the event of a failure to commence with the compliance of above-mentioned conditions within seven (7) calendar days after being notified in writing or failure to diligently pursue such compliance to completion, CITY is hereby authorized to proceed to have the defects repaired and made good at the expense of CONTRACTOR who hereby agrees to pay the cost and charges therefor immediately on demand.

If, in the opinion of CITY, nonconforming work creates a dangerous condition or requires immediate correction or repair to prevent further loss to CITY or to prevent interruption of operations, CITY shall attempt to give the CONTRACTOR notice. If CONTRACTOR cannot be

contacted or does not comply with CITY'S request for correction within a reasonable time as determined by CITY, CITY may proceed to make such correction or provide such repair. The costs of such correction or repair shall be charged against CONTRACTOR, who agrees to make payment for said costs upon demand.

Corrective action by CITY will not relieve CONTRACTOR or CONTRACTOR'S sureties or insurers of the guarantees and indemnities of this Agreement.

This paragraph does not in any way limit CITY'S remedies pursuant to Code of Civil Procedure, Section 337 and 337.15, or the guarantee on any items for which a longer guarantee is specified or on any items for which a manufacturer or supplier gives a longer guarantee period. CONTRACTOR agrees to act as a co-guarantor with such manufacturer or supplier and shall furnish CITY all appropriate guarantees or warranty certificates upon completion of the project. No manufacturer's guarantee period shall in any way limit the liability of CONTRACTOR or CONTRACTOR'S sureties and insurers under the indemnity or insurance provisions of this Agreement.

12. **CONTRACTORS AND AGENTS:** CONTRACTOR shall be as fully responsible to CITY for the acts and omissions of CONTRACTOR'S subcontractor and of the persons directly or indirectly employed by CONTRACTOR'S subcontractor as CONTRACTOR is for the acts and omissions of persons directly or indirectly employed by CONTRACTOR. Nothing contained in the Agreement shall create any contractual relationship between any subcontractor or others and CITY. CONTRACTOR shall bind every contractor to be bound by the terms of this Agreement.
13. **DEFAULT BY CONTRACTOR:** CONTRACTOR shall be in default of this Agreement if: CONTRACTOR refuses or fails to prosecute the work or any separable part thereof with such diligence as will ensure its completion within the time specified herein, or any written extension thereof, or fails to complete such work within such time, or if CONTRACTOR should be adjudged a bankrupt, make a general assignment for the benefit of creditors, or if a receiver should be appointed on account of CONTRACTOR'S insolvency, or if CONTRACTOR or any of their subcontractors violate any of the provisions of this Agreement, or if CONTRACTOR fails to make prompt payment for materials or labor, or if CONTRACTOR disregards laws, ordinances, or instructions of CITY. CITY may thereafter serve written notice upon the CONTRACTOR and CONTRACTOR'S surety of its intention to declare this Agreement in default. Said notice shall contain the reasons for such intention to declare a default. Unless, within ten (10) days after the service of such notice, such violations shall cease and satisfactory arrangements for the corrections thereof be made, this Agreement shall upon the expiration of said time be in default.

Upon such default, CITY shall serve written notice thereof upon the surety and CONTRACTOR, and the surety shall have the right to take over and perform this Agreement. If the surety does not, within fifteen (15) days after the serving upon it of a notice of a default, give CITY written notice of its intention to take over and perform this Agreement or does not commence performance thereof within thirty (30) days from the date of CITY'S notice, CITY may take over the work and prosecute the same to the extent of completion it deems necessary by contract or by any other method it may deem advisable for the account and at the expense of CONTRACTOR, and the surety shall be liable to CITY for any cost or other damage occasioned CITY thereby. In such event CITY may, without liability for so doing, take possession of, and utilize in completing such work, such materials, appliances, plants, and other property belonging to CONTRACTOR that may be on the site of the work and be necessary therefor. Should surety fail to take over and diligently perform the Agreement upon Principal's default, surety agrees to promptly on demand deposit with CITY such amount as CITY may reasonably estimate as the cost of completing all of CONTRACTOR'S obligations. For any such work the CITY elects to complete by furnishing its own employees, materials, tools, and equipment, CITY shall receive reasonable compensation therefor including costs of supervision and overhead.

CITY may, at its option, elect not to complete any or all of the work and may elect not to accept any of the work already completed. If CITY elects not to accept any of the work, then all CITY'S obligations to CONTRACTOR and the lands to be served shall terminate. CITY'S obligations to CONTRACTOR and the lands to be served shall continue to the extent of any acceptance, subject to CITY'S right to offset any sums due the CITY.

The foregoing provisions are in addition to and not in limitation of any other rights or remedies available to CITY.

14. **DELAY BY CONTRACTOR**: If the work is suspended or otherwise not continuously prosecuted for any cause whatsoever, within or without the time for completion, CONTRACTOR shall, at CONTRACTOR'S sole cost and expense, remove and replace all or any portion of the work already completed and inspected which CITY, in its sole discretion, determines is or can be damaged.
15. **ATTORNEYS' FEES AND COSTS**: Should CITY engage an attorney to enforce any provision of this Agreement or to defend any claim brought by anyone arising out of the failure of CONTRACTOR to perform any of CONTRACTOR'S obligations under this Agreement, CONTRACTOR shall pay all of CITY'S attorneys' fees incurred in connection therewith, with or without suit, whether or not said attorney is in the regular employ of the CITY.
16. **PREVAILING WAGES**: All work or services performed within the State of California pursuant to this Agreement by CONTRACTOR, CONTRACTOR'S employees and independent contractors, or CONTRACTOR'S subcontractors and its subcontractors' employees and independent contractors shall be performed by individuals lawfully permitted to perform such work or services in the State of California and/or the United States of America pursuant to all applicable State and/or Federal labor laws, rules and regulations including, but not limited to, any State or Federal law, rule or regulation prohibiting the employment of undocumented workers or any other person not lawfully permitted to perform said work or services in the State of California or the United States of America.

CONTRACTOR represents that it is an equal opportunity employer and shall not discriminate against any subcontractor, employee, or applicant ("person") for employment because of denial of family and medical care leave; race; religious creed (including religious dress and grooming practices); color; national origin (including language use restrictions); ancestry; physical disability or mental disability (including HIV and Aids); medical condition (cancer and genetic characteristics); genetic information; military or veteran status; marital status; gender, gender identity, and gender expression; sex (which includes pregnancy, childbirth, breastfeeding and medical conditions related to pregnancy, childbirth or breastfeeding); age or sexual orientation. Unless otherwise permitted under the law, CONTRACTOR shall not refuse to hire or employ any such person or refuse to select any such person for a training program leading to employment, or bar or discharge any such person from employment or from a training program leading to employment, or otherwise discriminate against any such person in compensation or in terms, conditions, or privileges of employment.

CONTRACTOR and all of CONTRACTOR'S subcontractors, if any, shall pay each employee engaged in all applicable trades or occupation not less than the prevailing hourly wage rate for work of a similar character in the locality in which the public work is performed, and not less than the general prevailing rate of per diem wages for holiday and overtime work. In accordance with the provisions of Section 1770 of the California Labor Code ("Labor Code"), the Director of Department of Industrial Relations of the State of California has determined the general prevailing rates of wages and employer payments for health and welfare, pension, vacation, travel time, and subsistence pay as provided for in Labor Code Section 1773.8, apprenticeship or other training programs authorized by Labor Code Section 3093 and similar purposes applicable to the work to be done. Said wages are available through the California

Department of Industrial Relations' Internet website at <http://www.dir.ca.gov/dlsr/PWD/index.htm> and are on file at City Hall, as provided in Section 1773.2 of the Labor Code. Said rates shall be posted at the Project site where work is to be performed, in accordance with Labor Code Section 1773.2. CONTRACTOR shall access a copy of the wage rate determination and shall make all subcontractors, if any, aware of the determination. As the wage determination for each craft reflects an expiration date, it shall be the CONTRACTOR'S responsibility to ensure that the prevailing wage rates of concern are current and paid. Subject to the safe harbor provisions of Labor Code Section 1775, CONTRACTOR shall forfeit to the CITY an amount not to exceed two hundred dollars (\$200) for each calendar day or portion thereof, as set by the Labor Commissioner in accordance with the terms of Labor Code section 1775, for each laborer, workmen or mechanics employed that is paid less than the general prevailing rate of wages herein referred to and stipulated for any work done under the proposed contract, by him, or by any subcontractor under him, in violation of the provisions of the Labor Code, and in particular, Sections 1770 to 1781 inclusive. CONTRACTOR and any and all or its subcontractors shall forfeit to the CITY twenty-five dollars (\$25) for each worker employed in the performance of this Agreement for each calendar day during which the worker is required or permitted to work more than eight (8) hours in any one calendar day and forty (40) hours in any one calendar week in violation of the provisions of Section 1813 of the Labor Code. In the event the total cost of the Project is thirty thousand dollars (\$30,000.00) or more, CONTRACTOR shall further comply with provisions set forth in Labor Code Section 1777.5 pertaining to employment of properly registered apprentices, including without limitation the obligation to (i) pay employed apprentices the prevailing rate of per diem wages for apprentices in the trade to which he or she is registered and shall be employed only at the work of craft or trade to which he or she is registered; (ii) employ apprentices in at least the ratio as set forth in said section; (iii) submit contract award information to an applicable apprenticeship program; and (iv) contribute to California Apprenticeship Council.

CONTRACTOR and all subcontractors hired to perform any work under the Project shall keep accurate payroll records, including the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each worker, in accordance with Section 1776 of the Labor Code. Payroll records shall be on forms provided by the Division of Labor Standards Enforcement ("DLSE") or in a manner containing the same information as the forms provided by the DLSE. Failure to comply with the above may result in monetary penalties to the CONTRACTOR or affected subcontractor. Payroll records shall be verified by written declaration made under penalty of perjury, that the information contained in the records is true and correct. CONTRACTOR and any and all subcontractors shall make a certified copy of all payroll records available for inspection by DLSE, the CITY or any member of the public and otherwise provide certified copies of such records to any of the foregoing within ten (10) days of CONTRACTOR'S and subcontractor's receipt of written request therefor. Failure to comply with the above may result in monetary penalties, in accordance with Labor Code Section 1776(d) and (h).

Notwithstanding anything else to the contrary, CONTRACTOR hereby acknowledges that all contractors must be registered with the Department of Industrial Relations ("Department") pursuant to Labor Code Section 1725.5 in order to be qualified to bid on, be listed in a bid proposal, subject to the requirements of Section 4104 of the Public Contract Code, or engage in the performance of any public work contract, including this Agreement, that is subject to the payment of prevailing wages. CONTRACTOR represents and warrants that CONTRACTOR is registered with the Department in the manner prescribed by the Department and has paid the requisite application fee, as required by Labor Code Section 1725.5. Moreover, prior to CONTRACTOR entering into any contracts with any subcontractor, CONTRACTOR shall obtain proof that all such subcontractors have also registered with the Department in accordance with Section 1725.5.

17. **ASSIGNMENT**: The performance of the Agreement may not be assigned except upon the written consent of CITY. Consent will not be given to any proposed assignment which would relieve CONTRACTOR or CONTRACTOR'S sureties of their responsibilities under the Agreement unless CITY finds that assignee can perform this Agreement and provide security comparable to that provided by CONTRACTOR.
18. **NOTICE**: All notices required hereunder shall be deemed served or given upon the earlier of actual receipt or deposit in the U.S. Postal Service, first class postage prepaid, addressed to CONTRACTOR at the address set forth below, to the surety at the address in the security instrument, and to CITY at 69-825 Highway 111, Rancho Mirage, California 92270.

**00 31 21 CITY OF RANCHO MIRAGE
 STANDARD AGREEMENT FOR PUBLIC WORKS CONSTRUCTION
 SIGNATURE REQUIREMENTS
 (Limited Partnership/General Partnership/Corporation)**

1 WHERE PRINCIPAL IS A LIMITED PARTNERSHIP

- A. General Partner shall execute on behalf of the limited partnership.
- B. General Partner shall furnish City of Rancho Mirage a copy of the recorded Certificate of Limited Partnership to authenticate the authority of the General Partner to sign on behalf of the limited partnership.

2 WHERE PRINCIPAL IS A GENERAL PARTNERSHIP

- A. General Partner shall execute on behalf of general partnership.
- B. General Partner shall furnish City of Rancho Mirage a copy of the General Partnership Agreement authenticating that the General Partner who signs the document has authority to do so.

3 WHERE PRINCIPAL IS A CORPORATION

- A. Officers shall execute on behalf of corporation.
- B. Officers shall furnish City of Rancho Mirage a copy of a corporate resolution indicating that the officers who sign the document are the officers of the corporation and authorized to bind the corporation to contract. Corporation requires two signatures.

In each of the foregoing situations (a limited partnership, a general partnership or a corporation) the CITY requires an individual obligor in addition to the partnership or corporate entity.

For example, John Doe may sign on behalf of either partnership or the corporation as the General Partner and/or president thereof, but then, in addition, John Doe is required to sign the document individually as an individual obligor.

By _____
(Authorized Representative of CITY) Date
Ted Weill

Title: Mayor _____

APPROVED AS TO FORM:

By: _____
City Attorney

ATTEST:

By: _____
City Clerk

(SEAL IF CORPORATION)

By _____
(Authorized Representative of Corporation) Date

Title _____

Address: _____

Telephone: _____

By _____
Individual Guarantor

Address _____

Telephone No. _____

By _____
Individual Guarantor

Address _____

Telephone No. _____

(SIGNATURES MUST BE NOTARIZED)

(Seal: Partnership/Corporation)

00 31 21.1 SCHEDULE A

STANDARD AGREEMENT FOR PUBLIC WORKS CONSTRUCTION

This schedule is attached to and made a part of the Standard Agreement for Construction of Public Improvements between CITY and CONTRACTOR for the above-referenced property.

- 1. Compensation: \$ _____
- 2. Completion TBD (280 days after construction start): To be determined by Notice to Proceed
- 3. Liability Insurance Limits:

General Liability

\$2,000,000	Each Occurrence (Includes Bodily Injury and Property Damage)
\$1,000	Medical Expense
\$1,000,000	Personal & Advertising Injury
\$2,000,000	General Aggregate
\$2,000,000	Products-Completed/Operations Aggregate

Automobile Liability

Combined Single Limit \$1,000,000 each accident and \$2,000,000 in the aggregate

Workers Compensation Statutory

- 4. Approved Security Amounts:
 - a. Performance
\$ _____
 - b. Payment
\$ _____

5. Bond Substitute Acceptable: Yes No (Cross out one)

6. Contractor(s):

<u>Name and Address</u>	<u>License No.</u>	<u>Phase of Work</u>
-------------------------	--------------------	----------------------

() Initial of CITY REPRESENTATIVE

() Initials of CONTRACTOR REPRESENTATIVE

00 31 21.2 LETTER OF CREDIT

CITY OF RANCHO MIRAGE
69-825 Highway 111
Rancho Mirage, CA 92270

Attention: Randy K Bynder, City Manager

Reference: Irrevocable Letter of Credit No. _____

Gentlemen:

This Letter of Credit is given to fulfill the requirements of that certain agreement entered into between the City of Rancho Mirage, a political subdivision of the State of California, hereinafter referred to as "CITY," and

_____ hereinafter referred to as "Principal," covering certain improvements to be installed in that certain project known and designated as:

As required by said agreement, and for that purpose only, we hereby establish in favor of CITY our Irrevocable Letter of Credit No. _____ in the amount of _____ U.S. dollars (\$ _____), to be paid by drafts at sight on us if accompanied by the following documents:

CITY'S written statement (signed by the City Manager or City Attorney) certifying that there has been failure of the Principal to perform the above agreement. Said statement shall declare the amount of the sight draft on us and that the amount of this draft is, therefore, now due and payable.

IT IS AGREED that the above funds are on deposit and guaranteed for payment and said funds shall become trust funds for the purposes set forth herein as required by Section 66499.6 of the Government Code of the State of California.

Upon our receipt, from time to time, of a signed and dated certificate, in the form below, from the City of Rancho Mirage, the amount of this Letter of Credit will be reduced by the amount stated in such certificate. Said certificate must read as follows:

Required improvement(s) has been performed in that certain project known and designated as _____. The amount and liability under Letter of Credit No. _____ is hereby reduced to \$_____

All drafts under this Letter of Credit shall be marked:

Name of Bank _____

Address _____

IRREVOCABLE LETTER OF CREDIT NO. _____

We expressly agree with you that all drafts drawn under and in compliance with the terms of this Letter of Credit shall meet with due honor upon representation. "Due honor" requires payment to CITY within three (3) banking days after presentation of demand.

This Letter of Credit shall be deemed automatically extended without amendment one year from the present and annually thereafter unless sixty (60) days prior to any such date bank shall notify City Clerk, by registered letter, that bank elects not to renew for such additional one year. In any event, this guaranteed Letter of Credit shall expire forty-five (45) days after CITY'S approval of the foregoing improvements, the recordation of the Notice of Acceptance and notification thereof to bank.

DATED: _____

Name of Bank _____

By: Authorizing Agent or Representative _____

APPROVED AS TO FORM: _____

City Attorney

Note: Letter must be submitted on bank letterhead with resolution or other documentation identifying signature as bank officer authorized to sign on behalf of bank.

00 31 21.4 PERFORMANCE BOND

We, _____, as Principal, and _____, as Surety, jointly and severally, firmly bind ourselves, our heirs, representatives, successors and assigns, as set forth herein, to the City of Rancho Mirage ("CITY") for payment of the penal sum of: _____

_____ U.S. Dollars (\$ _____).

CITY and Principal have entered into an agreement, or are about to enter into the agreement attached hereto and incorporated by reference, for the construction of public improvements for the property referenced in said agreement. Surety herein approves of the terms and conditions of said agreement and binds itself to faithfully perform the obligations of Principal therein if Principal fails to so perform. Surety acknowledges that the agreement herein referenced shall be that document as executed by CITY and Principal.

THE CONDITION OF THIS OBLIGATION IS SUCH that if the Principal shall in all things stand to and abide by, and well and truly keep and perform all of the covenants, conditions, and provisions in said agreement, and any alteration thereof made as therein provided, on Principal's part to be kept and performed at the time and in the manner therein specified, and shall indemnify and save harmless the CITY, CITY'S engineer, and their consultants, and each of their officials, directors, officers, employees and agents, as therein stipulated, then this obligation shall become null and void; otherwise, it shall be and remain in full force and effect.

Surety agrees that should it fail to take over and diligently perform the agreement upon Principal's default after notice and within the time specified in the agreement, Surety will promptly on demand deposit with CITY such amount as CITY may reasonably estimate as the cost of completing all of Principal's obligations. Surety's obligation for payment herein shall extend, notwithstanding any controversy between Principal and CITY regarding Principal's failure under the agreement should be conclusively presumed between the parties herein to relieve, as demanded, Surety's obligations herein and shall be deemed proper payment as between Principal and Surety.

Surety agrees that no change, extension of time, alteration, or addition to the terms of the agreement, or the work to be performed thereunder or the plans and specifications, or any matters unknown to Surety which may affect Surety's risk shall in any wise affect its obligation on this bond, and it does thereby waive notice thereof.

Principal and Surety agree that if the CITY is required to engage the services of an attorney in connection with the enforcement of this bond, each shall pay CITY'S reasonable attorneys' fees incurred, with or without suit, in addition to the above sum.

Executed this ____ day of _____, 20__.

Seal of Corporation

By _____
Authorized Representative of Principal

Title _____

By _____
Authorized Representative of Principal

Title _____

(ATTACH ACKNOWLEDGEMENT OF AUTHORIZED REPRESENTATIVES)

Any claims under this bond may be addressed to: (check one)

Surety's agent for service
of process in California:

() _____
Surety Company

Name

Street Number

Street Number

City and State

City and State

Telephone Number

Telephone Number

By _____
Attorney in Fact or other Representative

(ATTACH ACKNOWLEDGEMENT OF AUTHORIZED REPRESENTATIVE)

() _____
Company Agent

APPROVED AS TO FORM:

Street Number

City Attorney

City and State

Telephone Number

Furnish the name, address and phone number of the company agent as well as the surety company. Sureties must be authorized to do business in and have an agent for service of process in California and be on the accredited list of the United States Treasury Department (their bonds will be limited to such amounts as would be acceptable to the Treasury Department), and otherwise meet the requirements of section 7 of the agreement.

(NOTICE: No substitution or revision of this bond form shall be accepted.)

00 32 21.6 PAYMENT BOND

We, _____, as Principal, and _____, as Surety, jointly and severally, firmly bind ourselves, our heirs, representatives, successors and assigns, as set forth herein, to the City of Rancho Mirage ("CITY") and those for whose benefit this bond insures in the sum of _____ U.S. Dollars (\$_____). CITY and Principal have entered into an agreement, or are about to enter into the agreement attached hereto and incorporated by reference, for the construction of public improvements for the property referenced in said agreement. Surety herein approves of the terms and conditions of said agreement and binds itself to faithfully perform the obligations of Principal therein if Principal fails to so perform. Surety acknowledges that the agreement herein referenced shall be that document as executed by CITY and Principal. If Principal or any of Principal's contractors or subcontractors, fails to pay any of the persons named in Section 9000 et seq. of the California Civil Code employed in the performance of the agreement for materials furnished or for labor thereon of any kind, or for amounts due under the Unemployment Insurance Code with respect to such work or labor, then Surety shall pay the same in an amount not exceeding the sum specified above, and also shall pay, in case suit is brought upon this bond, such reasonable attorneys' fees as shall be fixed by the court.

Surety agrees that it shall pay the amounts due the persons above named and diligently perform the agreement upon Principal's default after notice and within the time specified in the agreement. If Surety fails to perform within the times specified in the agreement, Surety shall promptly on demand deposit with CITY such amount as CITY may reasonably estimate as the cost of completing all of Principal's obligations. Surety's obligation for payment herein shall extend, notwithstanding any controversy between Principal and CITY regarding Principal's failure under the agreement. Principal and Surety agree that any payment by Surety pursuant to this paragraph should be conclusively presumed between the parties herein to relieve, as demanded, Surety's obligation herein and shall be deemed proper payment as between Principal and Surety.

This bond shall insure to the benefit of any and all of the persons named in Section 9000 et seq. of the California Civil Code so as to give a right of action to them or their assigns in any suit brought upon this bond.

Surety agrees that no change, extension of time, alteration, or addition to the terms of the agreement, or the work to be performed thereunder, or the plans and specifications, or any matters unknown to Surety which might affect Surety's risk, shall in any way affect its obligation on this bond, and it does hereby waive notice thereof.

Principal and Surety agree that should CITY become a party to any action on this bond, that each will also pay CITY'S reasonable attorneys' fees incurred therein in addition to the above sums.

Executed this _____ day of _____, 20__.

Seal of Corporation

By _____
Authorized Representative of Principal
Title _____

(ATTACH ACKNOWLEDGEMENT)

By _____
Authorized Representative of Principal
Title _____

Any claims under this bond may be addressed to: (check one)

Surety's agent for service
of process in California:

() _____
Surety Company

Name

Street Number

Street Number

City and State

City and State

Telephone Number

Telephone Number

By _____
Attorney in Fact or other Representative

(ATTACH ACKNOWLEDGEMENT OF AUTHORIZED REPRESENTATIVE)

() _____
Company Agent

APPROVED AS TO FORM:

Street Number

CITY Attorney

City and State

Telephone Number

Furnish the name, address and phone number of the company agent as well as the surety company.

Sureties must be authorized to do business in and have an agent for service of process in California and be on the accredited list of the United States Treasury Department (their bonds will be limited to such amounts as would be acceptable to the Treasury Department), and otherwise meet the requirements of section 7 of the agreement.

(NOTICE: No substitution or revision of this bond form shall be accepted.)

00 31 22.1 CERTIFICATE OF COMPLETION OF STANDARD AGREEMENT FOR PUBLIC WORKS CONSTRUCTION

To induce the CITY OF RANCHO MIRAGE ("CITY") to accept all the work under the above dated Standard Agreement for Public Works Construction between CITY and CONTRACTOR, CONTRACTOR represents and certifies to CITY as follows:

- 1 All the work described in said agreement has been fully and completely performed in strict conformity with the agreement; and,
- 2. Except for final payments due CONTRACTOR or subcontractors which are contingent upon CITY'S acceptance, all transportation, equipment, labor, service, permits, utilities, and all other items used in completing the work have been fully paid for.

CONTRACTOR: _____ (Name) _____ (Phase of Work)

_____ (Date) _____ (Authorized Representative) _____ (Title)

CONTRACTOR: _____ (Name) _____ (Phase of Work)

_____ (Date) _____ (Authorized Representative) _____ (Title)

CONTRACTOR: _____ (Name) _____ (Phase of Work)

_____ (Date) _____ (Authorized Representative) _____ (Title)

CONTRACTOR: _____ (Name) _____ (Phase of Work)

_____ (Date) _____ (Authorized Representative) _____ (Title)

CONTRACTOR: _____ (Name) _____ (Phase of Work)

_____ (Date) _____ (Authorized Representative) _____ (Title)

Recording Requested By And
When Recorded Mail to:

CITY OF RANCHO MIRAGE
69-825 Highway 111
Rancho Mirage, CA 92270
No fee

00 31 22.4 NOTICE OF ACCEPTANCE

Notice is hereby given that the following public improvements have been completed and accepted by the CITY COUNCIL of the City of Rancho Mirage on _____, 20__.

(Brief description of improvements)

(General location)

_____ Rancho Mirage, California,

(Owner of property)

(Contractor(s))

This Notice of Acceptance is executed under authority of a directive from the City Council of the City of Rancho Mirage.

I, _____, declare under the penalty of perjury that I am the _____ of the City of Rancho Mirage, that I am familiar with the facts stated in the foregoing Notice of Acceptance executed for and on its behalf, and that I have read the foregoing Notice of Acceptance and know the contents thereof to be true.

DATED: _____, 20__.

(SIGNATURES MUST BE NOTARIZED)

Title

SECTION 00700-A

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SECTION 00700

GENERAL CONDITIONS OF THE CONTRACT

1. SCOPE OF WORK

The work to be done consists of furnishing all materials, equipment, tools labor and incidentals as required by the contract documents to construct the above stated project.

The general items of work to be done hereunder consist of civil, landscaping, and complete construction of the observatory facility as described in the contract documents (working drawings and specifications).

2. LOCATION OF WORK

The general location and limits of the work are: RANCHO MIRAGE LIBRARY

3. TIME FOR COMPLETION

Time is of the essence, therefore, the CONTRACTOR shall prioritize and schedule the work to be completed within the time specified in the Notice to Proceed and as set forth in Paragraph C.3 of the Standard Agreement, Section 00312-2, "Time For Completion", and shall be initiated as follows:

All long lead delivery time items shall be ordered immediately upon award of the contract. Vendor delivery date commitments shall be provided to the City of Rancho Mirage.

The Contractor shall determine the exact location of all existing utilities prior to commencing work. In the event the Contractor encounters underground utilities not shown on the plans, he/she shall verify the exact location of the utility and immediately notify the Engineer.

4. TRAFFIC REQUIREMENTS

Delineation shall be in accordance with the California Department of Transportation California Manual on Traffic Control Devices, 2012 Edition (California MUTCD), The Contractor shall submit a detailed construction detour plan consistent for Agency review and approval for each stage of construction prior to start of construction.

5. CORRELATION AND INTENT OF DOCUMENTS

The Standard Specifications for Public Works Construction (Green Book), 2012 Edition, project plans, special provisions, contract change orders, and all supplementary documents are essential parts of the contract, and a requirement occurring in one is as binding as though occurring in all. They are intended to be complimentary, and to describe and provide for a complete work.

Project Plans shall govern over Standard Plans; Standard Plans and Project Plans shall govern over the Standard Specifications; the Project Special Provisions shall govern over the Project Plans, Standard Specifications, and Standard Plans.

6. DETAIL DRAWINGS AND INSTRUCTIONS

The Engineer will furnish to the Contractor, with reasonable promptness, such further detail explanations, instructions and Drawings as may be necessary for the proper execution of the Work. In giving such additional instructions, the Engineer shall have authority to make minor changes in the Work, not involving extra cost, and not inconsistent with the intent of the Drawings and Specifications or the purposes of the improvement. The Contractor shall conform to the intent of the Contract, Drawings and Specifications. The Contractor shall not proceed with any portion of the work unless he is in possession of Plans and information necessary to its proper execution and completion.

The execution of the work as specifically detailed or explained without a written Change Order signed by the Owner and the Engineer, shall constitute an acceptance by the Contractor of detailed Drawings or information as being in conformity with the original intent of the Contract Documents.

7. NO ORAL AGREEMENTS

No oral agreement or conversation with any officer, agent, or employee of the Owner, either before or after execution of the Contract, shall affect or modify any of the terms or obligations contained in any of the documents comprising said Contract.

8. SHOP DRAWINGS

A. The Contractor shall submit for the approval of the Engineer shop, fabrication and setting drawings required by the Specifications or that may be requested by the Engineer, and no work shall be fabricated by the Contractor, except at his own risk, until such approval has been given.

B. Drawings shall be submitted in quadruplicate accompanied by letter or transmittal which shall give a list of the numbers and dates of the drawings submitted. Drawings shall be complete in every respect and bound in sets.

C. The Drawings submitted shall be marked with the name of the project, numbered consecutively and bear the approval of the Contractor as evidence that the Drawings submitted without this approval will be returned to the Contractor for re-submission.

D. The Contractor shall submit all Drawings and schedules sufficiently in advance of construction requirements to allow ample time for checking, correcting, resubmitting and rechecking.

If the shop drawings show variations from the requirements of the Contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in his letter of transmittal in order that, if acceptable, suitable action may be taken for proper adjustment; otherwise, the Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract even though such shop drawings have been approved.

E. If a Drawing as submitted indicates a departure from the Contract requirements which the Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in the Contract price or time for performance, he may approve the Drawings.

F. The approval of shop and setting drawings will be general and, except as provided above, shall not be construed: (1) as permitting any departure from the Contract requirements; (2) as relieving the Contractor of the responsibility of any error in details, dimensions or otherwise that may exist; (3) as approving departures from additional details or instructions previously furnished by the Engineer.

9. DRAWINGS AND SPECIFICATIONS

The Contractor shall keep on the work site a complete copy of the Drawings and Specifications, including all authorized Change Orders, in good condition, which shall always be available to the Owner, Engineer, and their representatives.

All Drawings, Specifications and copies thereof furnished to the Contractor are the property of the Owner and shall not be used on other work without its consent. Upon completion of this project, all copies of the Drawings and specifications shall be returned to the Engineer, as agent of the Owner.

10. MATERIALS, WORKMANSHIP

All materials used in the project, unless otherwise specified, shall be new, of the types and grades specified, and the Contractor shall, if requested, furnish evidence satisfactory to the Engineer that such is the case. All workmanship shall be of the best quality and all workers shall be adequately skilled in the work which they perform.

11. DEFECTIVE WORK AND MATERIALS

The Contractor shall promptly remove from the premises all materials condemned by the Owner, the Contractor shall promptly replace and re-execute his work in accordance with the Contract and shall perform that work without expense to the Owner and shall bear the expense of making good all work of other Contractors destroyed or damaged by such removal or replacement. If the Engineer and Owner deem it expedient to correct work injured or done not in accordance with the Contract, the difference in value together with a fair allowance for damage shall be deducted from the sum agreed to be paid the Contractor for the performance of the Contract.

12. SUBSTITUTIONS OF MATERIALS AND EQUIPMENT

Materials and equipment, including specially designated makes, must be furnished as specified except when equals are approved by the Owner. Equals will not be accepted unless the Contractor requests and receives permission in writing from the Owner to make specific substitutions. Requests shall be made within sufficient time to allow the Owner to investigate the merits of the proposed substitutes, and the Contractor shall present complete details with specific explanations of the characteristics of those details, which differ, from the Specifications.

13. CONTRACTOR'S TITLE TO MATERIALS

No materials or supplies for the work shall be purchased by the Contractor or by any subcontractor subject to any chattel mortgage or under a conditional sale or other agreement by which an interest is retained by the seller. The Contractor warrants that he has good title to all materials and supplies for which he accepts partial payment.

14. LICENSES, PERMITS, LAWS AND REGULATIONS

The contractor, acting in the name of the Owner, shall obtain and pay, only where legally required, for all licenses and permits, inspections and inspection certificates, required to be obtained from or made by any authority having jurisdiction over any part of the work included in the Contract. The Contractor shall comply with all laws, ordinances and regulations applicable to the work.

15. PATENTS, ROYALTIES AND TAXES

The Contractor shall hold the Owner and the Engineer harmless from liability of any nature, including costs and expenses, for or on account of any patented or unpatented article, appliance, or device used in the performance of the Contract and shall defend all suits or claims for infringement of any patent right. He shall pay all applicable Federal, State and local sales taxes and all other taxes pertinent to the work involved in this Contract.

16. ENGINEERING, SURVEY AND SITE EXAMINATION

The Contractor shall be responsible for having ascertained pertinent local conditions such as location, accessibility and general character of the site and for having satisfied himself as to the conditions under which the work is to be performed. No claim for allowances because of his error or negligence in acquainting himself with the conditions at this site will be recognized.

The Owner will furnish surveys necessary to properly locate the improvements and establish the locations thereof, with general reference points as well, that in the Owner's judgment enable the Contractor to proceed with the work.

The Contractor shall provide competent engineering services to lay out the work and all parts thereof and to establish all grades and elevations in accordance with the Contract requirements. He shall verify the figures shown on the survey cut sheets, field stakes and the approved drawings before undertaking any construction work and shall be responsible for the accuracy of the finished work.

The Contractor shall protect and preserve established bench marks and monuments and shall make no changes in locations without the written approval of the Owner. Any bench marks or monuments which are lost or destroyed shall be replaced by a licensed land surveyor at the full expense of the Contractor subsequent to proper notification of the Owner and with his approval.

Any ties, monuments and bench marks disturbed during construction shall be reset by a Licensed Land Surveyor per City and County standards after construction and the tie notes submitted to the City on 8-1/2" x 11" heavy stock grid-lined survey record paper. The tie record shall be signed by the Licensed Surveyor and a corner record shall be filed with the County of Riverside at the Contractor's expense. The Contractor and his sureties shall be liable for, at his expense, any resurvey required due to his negligence in protecting existing ties, monuments, bench marks or any such horizontal or vertical controls.

17. PROTECTION OF WORK AND PROPERTY

The Contractor shall at all times safely guard the Owner's property from injury or loss in connection with this Contract. He shall at all times safely guard and protect his own work and adjacent property from damage. All passageways, guard fences, lights and other facilities required for protection by State of municipal laws and regulations and local conditions shall be provided and maintained. Existing pavements located on or near the

site shall be protected against damage, and pavements that are accidentally damaged or necessarily cut shall be replaced with the same material upon completion of the work.

18. ACCIDENT PREVENTION

Precaution shall be exercised at all times for the protection of persons, including employees, and property. The safety provisions of applicable laws, building and construction codes shall be observed. The Contractor shall maintain sufficient safeguards, such as railings, temporary walks, lights, etc., against the occurrence of accidents, injuries, damage or harm to any person or property and shall also be responsible for the same if such occur.

19. EMERGENCIES

In an emergency affecting the safety of life or of any structure or of adjoining property, the Contractor shall take all necessary and proper steps to prevent any threatened loss or injury. If practicable, the Contractor shall communicate with the Owner and shall be guided by the directions and advice of the Owner. But if the character of the emergency is such as to require action with such short limits or time or under circumstances rendering that impracticable, then the Contractor shall act independently and upon his own responsibility, subject to the direction and control of the Owner as soon as it may become practicable to obtain the same.

20. ACCESS TO THE WORK

The Engineer, the Owner, and their representatives shall have access at all times to the work for purposes of inspection, wherever said work is in preparation or progress, and the Contractor shall provide proper facilities for such access and inspection.

21. INSPECTION OF THE WORK

All material and workmanship (if not otherwise designated by the Specifications) shall be subject to inspection, examination, and test by the Engineer at any all times during manufacture and/or construction and at any and all places where such manufacture and/or construction are carried on. The Engineer shall have the right to reject defective material and workmanship or require its correction. Should the Specifications, the Engineer's instructions, any law, ordinances or public authority require any work to be specially tested or approved, the Contractor shall give the Engineer timely notice of its readiness for inspection, and if the inspection is by an authority other than the Engineer, of the date fixed for such inspection. If any work should be covered, without proper inspection and without approval or consent of the Engineer, it shall, if required by the Engineer, be uncovered for examination at the Contractor's expense.

22. INSPECTOR

The Owner may employ an Inspector, who will act as a direct representative of the Owner or the Engineer, and who shall provide full-time and continuous personal supervision and inspection of the work. Such supervision and inspection shall not, in any way relieve the Contractor from responsibility for full compliance with all of the terms and conditions of the Contract, nor be construed to lessen to any degree, the Contractor's responsibility for providing efficient and capable superintendence as required herein. The Inspector is not authorized to make changes in the Drawings or Specifications, nor shall his approval of work and methods relieve the Contractor of responsibility for the correction of subsequently discovered defects.

No work of any kind shall be performed on the project site outside of the regularly established working hours without the knowledge and consent of the Inspector.

23. SUPERVISION OF CONTRACTOR

The CONTRACTOR shall give his personal attention constantly to the faithful prosecution of the work, and shall be present, either in person or be represented by a duly authorized and competent SUPERINTENDENT satisfactory to the ENGINEER, continually at the site of the work during progress, to receive directions or instructions from the OWNER. The SUPERINTENDENT shall be qualified to, and shall, represent the CONTRACTOR during all times when the CONTRACTOR is not present and all orders or directions issued to the SUPERINTENDENT by the OWNER shall be as binding as if given to the CONTRACTOR personally. Important directions shall be confirmed in writing to the CONTRACTOR. Other directions shall be so confirmed upon written request in each case. The CONTRACTOR shall designate the Project SUPERINTENDENT in writing to the CITY and obtain ENGINEER approval prior to the start of construction. Both the CONTRACTOR and the SUPERINTENDENT shall cooperate to provide efficient and complete supervision over all phases of the work.

24. **CHANGES IN THE WORK**

The Owner, upon agreement with the Contractor, without invalidating the Contract, may order extra work or make changes by altering, adding to, or deducting from the work, the Contract sum being adjusted accordingly. The Contractor shall not be authorized to comply with such order without previously obtaining written authority therefore from the Owner. All such work shall be executed under the conditions of the original Contract, except that any claims for extension of time caused thereby shall be adjusted at the time of ordering such change.

The Contractor shall, when requested by the Owner, furnish an itemized breakdown of the quantities and prices used in computing the value of any change that may be ordered. If in the opinion of the Contractor any instructions, detail Drawings or notices of any description issued by the Engineer or Owner involve extra cost above the Contract price he shall immediately give the Owner written notice to that effect before proceeding with the work involved. The execution of work without prior submission of such written notice shall constitute the contractor's acceptance of the work as being within the Contract price.

The Contractor agrees that any change orders for extra work represent an accord and satisfaction between the owner and Contractor for such extra work. The Contractor's change order shall contain the entire claim of Contractor for all such extra work, including but not limited to claims for delay, disruption, and acceleration damages. Contractor waives any further claim for costs and damages except as specifically set forth in the change order.

25. **DELAYS**

25.1 **Notice of Delays** – When the CONTRACTOR foresees a delay in the prosecution of the Work and, in any event, immediately upon the occurrence of a delay, the CONTRACTOR shall notify the ENGINEER in writing of the probability of the occurrence and the estimated extent of the delay, and its cause. The CONTRACTOR agrees that no claim shall be made for delays, which are not called to the attention of the ENGINEER at the time of their occurrence.

25.2 **Avoidable Delays** – Avoidable delays in the prosecution of the Work shall include delays, which could have been avoided by the exercise of care, prudence, foresight and diligence on the part of the CONTRACTOR or its subcontractors, at any tier level, or suppliers.

25.3 **Unavoidable Delays** – Unavoidable delays in the prosecution or completion of the Work shall include delays which result from causes beyond the control of the CONTRACTOR and which could not have been avoided by the exercise of care, prudence, foresight and diligence on the part of the Contractor or his subcontractors, at any tier level, or suppliers.

Delays in completion of the Work of other Contractors employed by the CITY will be considered unavoidable delays insofar as they interfere with the CONTRACTOR's completion of the current critical activity or item of the Work.

25.4 **Abnormal Delays** – Delays caused by acts of God, fire, unusual storms, floods, tidal waves, earthquakes, strikes, labor disputes, freight embargoes, and shortages of materials shall be considered as unavoidable delays insofar as they prevent the CONTRACTOR from proceeding with at least seventy-five (75) percent of the normal labor and equipment force for at least five (5) hours per day toward completion of the current critical activity item on the favorably reviewed progress schedule.

25.5 **Material Shortages** – Upon the submission of satisfactory proof to the ENGINEER by the CONTRACTOR, a shortage of materials outside the control of the CONTRACTOR will be acceptable as

grounds for granting a time extension. In order that such proof may be satisfactory and acceptable to the ENGINEER, it must be demonstrated by the CONTRACTOR that the CONTRACTOR has made every effort to obtain such materials from all known sources within reasonable reach of the proposed Work and was not due to a lack of scheduling or planning on the CONTRACTOR's part.

Only the physical shortage of material caused by unusual circumstances will be considered under these provisions as a cause for Extension of Time, and no consideration will be given to any claim that material could not be obtained at a reasonable, practical, or economical cost or price, unless it is shown to the satisfaction of the ENGINEER that such material could have been obtained only at exorbitant prices entirely out of line with current rates, taking into account the quantities involved and usual practices in obtaining such quantities. A time extension for shortage of materials will not be considered for material ordered or delivered late or whole availability is affected by virtue of the mishandling of procurement. The above provisions apply equally to equipment to be installed in the Work.

26. TIME EXTENSIONS

26.1 **Avoidable Delay** – The AGENCY may grant an Extension of Time for avoidable delays if the AGENCY deems it is in its best interest. If the AGENCY grants an Extension of Time for avoidable delays, the CONTRACTOR agrees to pay the AGENCY's actual costs, including changes for engineering, inspection and administration incurred during the extension.

26.2 **Unavoidable Delay** – If the CONTRACTOR is delayed in the performance of its work by an act of the CITY or if the CONTRACTOR is delayed in the performance of its work by an unavoidable delay, then the Contract completion date may be extended by the CITY for such time that, in the AGENCY's and ENGINEER's opinion, the CONTRACTOR's completion date will be unavoidably delayed, provided that the CONTRACTOR strictly fulfills the following:

- a. The CONTRACTOR shall provide notification in accordance with Section 25.1 **Notice of Delays** and submit in writing a request for an Extension of Time to the ENGINEER stating at a minimum the probable cause of the delay and the number of days being requested. The time extension request shall be submitted along with a time impact analysis.
- b. If requested by the ENGINEER, the CONTRACTOR shall promptly provide sufficient information to the ENGINEER to assess the cause or effect of the alleged delay, or to determine if other concurrent delays affected the work.
- c. Weather Delays. The CONTRACTOR will be granted a non-compensable time extension for weather-caused delays.

Should the CONTRACTOR fail to fulfill any of the foregoing, which are considered conditions precedent to the right to receive a Time Extension, the CONTRACTOR waives the right to receive a time extension.

Should the CONTRACTOR fail to complete the work within the time specified in the contract, as extended in accordance with this clause if appropriate, the CONTRACTOR shall pay to the AGENCY liquidated damages as specified in the Special Provisions of these specifications.

During such extension of time, neither extra compensation for engineering, inspection and administration, nor damages for delay will be charged to the CONTRACTOR. It is understood and agreed by the CONTRACTOR and AGENCY that time extensions due to unavoidable delays will be granted only if such unavoidable delays involve controlling operations which would prevent completion of the whole Work within the specified Contract Time.

26.3 **Indirect Overhead** – The CONTRACTOR shall be reimbursed for indirect overhead expenses for periods of time when the Work is stopped due to Unavoidable Delays as defined in Section 25.3, of these General Conditions. However, no reimbursement for indirect overhead shall be made for delays as defined in Section 25.4 Abnormal Delays; Section 26.2.c. Weather Delays; or Section 25.5, Material Shortages of these General Conditions.

As a condition precedent to any reimbursement, the CONTRACTOR must fulfill all conditions as provided Section 26.2, Unavoidable Delay.

The reimbursement of indirect overhead is limited to those delay conditions defined above when the CONTRACTOR is prevented from proceeding with seventy-five (75) percent of the normal labor and equipment

force for at least five (5) hours per day toward completion of the current critical activity item(s) on the current favorably reviewed progress schedule.

26.4 Indirect Field Overhead – For those allowable delay periods as defined in Section 25.3 of these General Conditions, the CONTRACTOR shall be reimbursed for its indirect field overhead based on:

- a. Invoices for all field office equipment.
- b. Actual salary for field office staff.
- c. Fair rental values acceptable to the ENGINEER for construction equipment idled due to the delay.

26.5 Home Office Overhead – For those allowable delay periods as defined in Section 25.3, Unavoidable Delays, the CONTRACTOR shall be reimbursed for its home office overhead based on the following formula:

Contract Bid price divided by Contract Period Calendar Days x 0.03 = Daily Home Office Overhead (\$/Day).

Such reimbursement shall be mutually agreed between the AGENCY and CONTRACTOR to encompass full payment for any home office overhead expenses for such periods of time for the CONTRACTOR and all subcontractors. The CONTRACTOR agrees to hold the AGENCY harmless for any indirect overhead claims from its subcontractors.

27. OWNER'S RIGHT TO DO WORK

Should the Contractor, at any time during the process of construction, fail or refuse to furnish enough materials and/or workers to properly prosecute the work, unless prohibited from so doing though the action of the Owner, the Engineer, or other authorized official agencies, the Owner, after giving two (2) days written notice to the Contractor may, without prejudice to any other rights he may have, proceed with and/or complete the work, and may deduct the cost thereof, together with reasonable expenses arising from such procedure, from any amounts then due or which may thereafter become due to the Contractor.

28. OWNER'S RIGHT TO TERMINATE THE CONTRACT

If the Contractor should be adjudged a bankruptcy, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, if he should, except in cases stated in the following paragraph, persistently or repeatedly refuse or fail to supply enough properly skilled workers or proper materials, or if he should fail to make prompt payment to subcontractors or for materials or labor, persistently disregard laws, ordinances or the instruction of the Owner, or otherwise be guilty of a substantial violation of any provision of the Contract, then the Owner, upon certificate of the Engineer that sufficient cause exists to justify such action, may, without prejudice to any other right or remedy after giving the Contractor ten (10) days written notice, terminate the employment of the Contractor and take possession of the premises and of all materials, tools, and appliances thereon and finish the work by whatever he may deem expedient. In such case, the Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the contract price shall exceed the expense of finishing the work including compensation to the Engineer for his additional services, such excess shall be paid to the Contractor. If such expense shall exceed such unpaid balance, the Contractor shall pay the difference to the Owner.

29. CONTRACTOR'S RIGHT TO TERMINATE THE CONTRACT

If through no fault of the Contractor, or of anyone employed by him (1) the work is stopped by order of any court or governmental authority, other than the Owner, (2) the Engineer capriciously or arbitrarily fails to issue any certificate for payment within thirty (30) days after it is due, or (3) the Owner fails to pay to the Contractor, within sixty (60) days after presentation of the Engineer's certificate to the Owner, any sum certified by the Engineer, then the Contractor may upon ten (10) days written notice to the Owner and the Engineer stop work or terminate the Contract, and the Owner shall be liable to the Contractor for any loss sustained and reasonable profit.

30. PAYMENTS WITHHELD

The Engineer may withhold or, on account of subsequent discovered evidence, nullify the whole or a part of any certificate for payment to such extent as may be necessary to protect the Owner from loss on account of:

- A. Defective work not remedied.
- B. Claims filed, or reasonable evidence indicating probable filing of claims.

- C. Failure of the Contractor to make payments properly to subcontractor or for material or labor.
- D. A reasonable doubt that the Contract can be completed for the balance remaining unpaid.
- E. Damage to another Contractor.
- F. Default of the Contractor in the performance of the terms of the Contract.

31. **LIENS**

The Contractor agrees that at any time upon request of either the Owner or the Engineer, he will submit a sworn statement setting forth the work performed or material furnished by subcontractors and material suppliers, and the amount due and to become due to each, and that before the final payment called for hereunder he will, if requested, submit to the Owner or the Engineer a complete set of vouchers showing what payments have been made for materials and labor used in connection with the work.

32. **ASSIGNMENTS**

The Contractor shall not assign the whole or any part of this Contract without the written consent of the Owner and all Sureties executing bonds on behalf of the Contractor in connection with said Contract.

33. **MUTUAL RESPONSIBILITY OF CONTRACTORS**

If the Contractor or any of his subcontractors or employees cause loss or damage to any separate Contract on the work, the Contractor agrees to settle with such separate Contractor by agreement or arbitration, if he will so settle. If such separate Contractor sues the Owner, on account of any loss so sustained, the Owner shall notify the Contractor, who shall indemnify and save harmless the Owner against any expenses and judgment arising therefrom.

34. **SEPARATE CONTRACTS**

The Owner reserves the right to award other contracts in connection with the project and the work, under which may proceed simultaneously with the execution of this Contract. The Contractor shall coordinate operations with those of other Contractors. Cooperation will be required in the arrangement for the storage of materials, and in the detailed execution of the work. The Contractor, including his subcontractors, shall keep himself informed of the progress and the detail work of other Contractors and shall notify the Engineer immediately of lack of progress or defective workmanship on the part of other Contractors where such delay or such defective workmanship will interfere with his own operations. Failure of a Contractor to keep informed of the work progressing on the site and failure to give notice of lack of progress or defective workmanship by others shall be construed as acceptance by him of the status of the work as being satisfactory for proper coordination with his own work.

35. **SUBCONTRACTS**

- A. The Contractor may, without additional expense to the Owner, utilize the services of subcontractors on those parts of the work that are specified to be performed by subcontractors.
- B. Nothing contained in the Specifications of Drawings shall be construed as creating any contractual relationship between any subcontractor and the Owner. The divisions or sections of the Specifications are not intended to control the Contractor in dividing the work among subcontractors or to limit the work performed by any trade.
- C. The Contractor shall be as fully responsible to the Owner for the acts and omissions of subcontractors and of persons employed by them, as he is for the acts and omissions of persons directly employed by him.
- D. The Contractor shall be responsible for the coordination of the trades, subcontractors and material men engaged upon his work.
- E. Neither the Owner nor Engineer will undertake to settle any differences between the Contractor and his subcontractors or between subcontractors.
- F. The Contractor shall cause appropriate provisions to be inserted in all subcontract relative to the work to bind subcontractors to the Contractor by the terms of the General Conditions and other Contract Documents insofar as applicable to the work of subcontractors.

G. The Owner and the Engineer reserve the right to approve all subcontractors. Such approval shall be a consideration to the awarding of the Contract and unless notification to the contrary is given to the Contractor prior to the signing of the Contract, the list of subcontractors, which is submitted with his proposal, will be deemed to be acceptable.

H. In accordance with Section 4101 of the Government Code, each bidder, in his bid, shall set forth: (1) the name and location of the place of business of each subcontractor who will perform work or labor, or render services to the Contractor in or about the construction of the work, or improvement, in an amount in excess of one half of 1% of the Contractor's total bid, and (2) the portion of the work which will be done by each such subcontractor.

I. In accordance with Section 4105 of the Government Code, if the Contractor fails to specify such subcontracts, he agrees to perform that portion of the work himself.

J. In accordance with Sections 4107 and 4107.5 of the Government Code, no Contractor whose bid is accepted shall without consent of the awarding authority, either: (1) substitute any person as a subcontractor in place of the subcontractor designated in the original bid; or (2) permit any such subcontractor to be assigned or transferred, or allow it to be performed by anyone other than the original subcontractor listed in the bid; or (3) sublet or subcontract any portion of the work in excess of one half of 1% of the Contractor's total bid as to which his original bid did not designate a subcontractor.

36. USE OF WORK AREA AND CLEANING

The Contractor shall maintain the work area under his control in an orderly condition. He shall store his apparatus, materials, supplies and equipment in such a manner as will not interfere with the daily operations of adjacent businesses or residences during the week. The Engineer shall approve all storage and field yard areas. The Contractor shall not permit any load or stress to be placed upon any part of the permanent work or existing work that will endanger the safety or strength of said work.

37. CORRECTION OF WORK AFTER FINAL PAYMENT AND GUARANTEE ONE YEAR

Neither the final certificate, final payment, or any provision in the Contract Documents shall relieve the Contractor of responsibility for faulty materials or workmanship, and he shall remedy any defects due thereto and pay for any damage to other work resulting therefrom, which may appear to be discovered up to one year after recording of the Notice of Completion. The Owner shall give notice of observed defects with reasonable promptness, and the Contractor shall proceed to remedy such defects immediately upon receiving such notification. Payments due to the Engineer by the Owner for extra engineering services required in the enforcement of Contractor's guarantee after acceptance of the work shall be paid to the Owner by the Contractor or his Surety.

38. OCCUPANCY BY THE OWNER

The Owner has the right to occupy and to use the any and all parts of the property to the completion of the entire work, and that such use shall not operate as an acceptance of any part of the work.

39. DAMAGE TO ADJACENT AND EXISTING PROPERTY

The Contractor shall be responsible for any and all damage done to existing property and adjacent construction work during all construction work under this Contract, and he shall make any repairs that result from his operations to the satisfaction of the Owner.

40. UTILITIES

The Contractor shall furnish and pay for all water, gas, electricity and other utilities used for construction purposes, unless otherwise provided in the Special Conditions or Specifications.

41. TEMPORARY TOILET

The Contractor shall construct a chemical toilet or temporary toilet connected to a cesspool for the use of all persons connected with the work. Structure shall have roof and door and shall be fly-proof. At conclusion of the work, the chemical toilet or cesspool and toilet shall be removed from the premises and excavation filled and left in a thoroughly sanitary condition. Exact location must be approved by the Engineer.

42. CLIMATIC CONDITIONS

The Contractor shall provide and maintain heat, fuel, materials, and services necessary to protect all work and materials against injury from extreme heat, cold, dry winds, or dampness as follows:

- A. At all times during the placing, setting and curing of concrete and cement work, provide sufficient heat to insure the heating of spaces involved to not less than fifty (50) degrees Fahrenheit.
- B. The Engineer shall have full authority to suspend operations on work when subject to damage by climatic conditions or because of insufficient curing or drying of surfaces or materials.

43. LAWS CONCERNING THE OWNER A PART HEREOF

The Contract is subject to all provisions of the constitution and laws of California governing, controlling or affecting the Owner, or the property, funds, operations or powers of the Owner, and such provisions are by this reference made a part hereof and of the Contract.

44. WAGES AND HOURS

The Owner has determined that the minimum wages paid on this project shall not be less than those set forth in the Notice Inviting Bids. It is the responsibility of bidders to inform themselves as to local labor conditions and prospective changes or adjustments of wage rates. No increase in the Contract price shall be allowed or authorized on account of the payment of increased wage rates.

In accordance with the provisions and requirements of section 1810-16 of the Labor Code, neither the contractor or the subcontractor who employs, directs, or controls the work of any worker employed to execute work done under the Contract, shall require or permit such worker to labor more than eight (8) hours during any one calendar day, except in cases of extraordinary emergency, caused by fire, flood or danger to life or property. Within thirty (30) days after any worker is permitted to work over eight (8) hours in one calendar day due to such extraordinary emergency, the Contractor shall file with the Owner a verified report settling the nature of the emergency. The report shall contain the name of the worker and the hours worked by him on the particular day. Failure to file the report within the thirty (30) day period shall be prima facie evidence that no extraordinary emergency existed. The Contractor and every subcontractor shall keep an accurate record showing the name of, and actual hours worked by, each worker employed by him in connection with the work executed under the Contract. The record shall be kept open to all reasonable hours to the inspection of the Owner and the Division of Labor Law Enforcement. The contractor shall forfeit, as a penalty to the Owner, up to \$200.00 for each worker employed in the execution of the Contract by the contractor or by any subcontractor for each calendar day during which any worker is required or permitted to labor more than eight (8) hours, in violation thereof.

45. BRAND OR TRADE NAME, SUBSTITUTION OF "EQUALS"

The provisions of this paragraph control over the provisions of paragraph 10 of these General Conditions.

Whenever any material, product, thing or services is specified by brand or trade name, the specified name shall be deemed to be followed by the words "or equal" (except where the product is designated to match others in use on a particular public improvement; either completed or in the course of completion).

As a part of his Bid Proposal any bidder must include a request for a substitution of an item "equal" to any so specified by brand or trade name. Within twenty-one (21) calendar days after award of the Contract, the Contractor may submit to the Engineer data substantiating such a request made in his Bid Proposal; otherwise the request shall be deemed to have been withdrawn. Such submission shall include data showing the equality, his reasons for making the request, and the difference, if any, in cost to the Contractor. The Engineer shall promptly investigate the request and make a recommendation to the Owner, who shall promptly determine whether or not the substitute is equal in every respect to the items specified, shall grant or deny the request accordingly, and shall notify the Contractor in writing. Unless the request is granted by the governing board of the Owner, the substitution shall not be permitted. Nothing herein shall authorize any change in the Contract price nor prevent the use of Change Orders in the manner authorized by law for the project.

46. NOTICE OF COMPLETION

Within ten (10) days after the completion of construction in accordance with the Contract, the Contractor shall promptly notify the Engineer when construction is complete to enable the Engineer to make his final inspection, prepare a report and inform the Owner. Upon review and acceptance of the Engineer's report, the Owner shall cause a Notice of Completion to be recorded in the office of the County Recorder. Any significant deficiencies or

requests for missing or incomplete portions of the work or submittals found within the report may be cause to withhold filing a Notice of Completion to allow the CONTRACTOR time to provide correction or remedy.

47. EQUAL OPPORTUNITY

The Contractor herein agrees not to discriminate in its recruiting, hiring, promotion, demotion or termination practices on the basis of race, religious creed, national origin, ancestry, sex, age, sexual preference or physical handicap in the performance of this Contract and to comply with the provisions of the State Fair Employment Practices as set forth in Part 4.5 of Division 2 of the California Labor Code.

48. PROGRESS SCHEDULE

The Contractor shall furnish three (3) copies of Job Progress Schedule to the Owner at the start of the construction and shall provide updates regularly as necessary, or as stipulated and requested by the Owner or his representative.

49. PRECONSTRUCTION CONFERENCE

The OWNER shall call a preconstruction conference after the award of the Construction Contract. A principal of the CONTRACTOR shall attend such a conference. At the conference, CONTRACTOR shall submit the name of the proposed Project SUPERINTENDENT for the project, along with a description of documented experience and references to verify the competency of the same. The CONTRACTOR shall also submit the names of each person authorized to execute Change Orders for and on behalf of the CONTRACTOR, a critical path construction schedule, showing the method by which CONTRACTOR proposed to accomplish the work and proposed completion dates of different aspects of the work, and what arrangements the CONTRACTOR wishes as to storage of on-site materials or equipment for the project.

At the preconstruction conference, CONTRACTOR will be asked whether he is aware of any ambiguity in the Contract Documents requiring clarification and whether the methods of accomplishment of the work provided for in the specifications are appropriate.

CONTRACTOR shall at the preconstruction conference report in detail as to what steps have been taken to provide the requisite personnel to accomplish the work, whether listed subcontractors have entered into subcontracts with him and what arrangements have been made for providing necessary equipment and material for the accomplishment of the work.

At the preconstruction conference, the CONTRACTOR shall submit to the ENGINEER a Schedule of Values of the various portions of the work, including quantities if required by the ENGINEER aggregating the total Contract Sum, divided so as to facilitate payment, prepared in such form as specified or as the ENGINEER and CONTRACTOR may agree upon, and supported by such data to substantiate its correctness as the ENGINEER may require. Each item in the Schedule of Values shall include its proper share of overhead and profit. This schedule, when approved by the ENGINEER, shall be used as a basis for CONTRACTOR 'S Applications for Payment.

The Contractor shall also provide the following submittals at or prior to the preconstruction meeting:

1. A Storm Water Pollution Prevention Plan (SWPPP).
2. Vendor submittals and confirmation showing proof of ordering with delivery dates for all long lead items.
3. A traffic control, phasing and staging plan. (The traffic control plan shall include designated paths of travel for the disabled in compliance with the requirements of Title 24 and the Americans with Disabilities Act [ADA] through or around the project work area.)
4. Copies of permits.
5. Any requests for variances or substitutions.

END OF SECTION

SPECIAL PROVISIONS**00 800 SP1 PART 1 - GENERAL PROVISIONS**

The Standard Specifications of the City are contained in the Standard Specifications for Public Works Construction ("Green Book"), 2012 Edition as written and promulgated by the Joint Cooperative Committee of the Southern California Chapter of the American Public Works Association and the Southern California District of the Associated General Contractors of California. Copies of these Standard Specifications are available from the publisher:

Building News, Incorporated
990 Park Center Drive, Suite E
Vista, CA 92081
(760) 734-1113

The Standard Specifications set forth above will control the general provisions, construction materials and construction methods for this contract except as amended by the Plans, Special Provisions, or other contract documents.

The Section Numbers of the following Special Provisions coincide with those of the Standard Specifications for Public Works Construction ("Green Book"), 2012 Edition. Only those sections requiring amendment or elaboration, or specifying options, are called out.

The Standard Specifications shall prevail in all cases except where a Contract Document of a higher order, provides a different requirement on a given topic or topic aspect. All language in the Standard Specifications that is not in conflict with the language in the prevailing contract Documents on a given topic or topic aspect shall remain in full force and effect, unless the language in the prevailing Contract Document specifically cites the section number in the Standard Specification and states that said provision is in lieu of that Standard Specification section.

References in the Special Provisions to "CALTRANS Standard Specifications" shall mean the Standard Specifications (2010 Edition or any updates thereof) of the State of California, Department of Transportation. Copies of these specifications may be obtained from the internet at dot.ca.gov/hq/esc/techpubs/, or:

State of California – Department of Transportation
1820 Alhambra Blvd.
MS 9/101
Sacramento, California 95816-8041
(916) 227-4132

References in the Special Provisions to Standard Plans shall mean the most recent Standard Plans of the City of Rancho Mirage and where applicable, the Riverside County and the State Department of Transportation, 2010 edition, or any updates thereof. Applicable Standard Plans for this project are contained in the Appendix of the Specifications.

Where the Plans or Specifications describe portions of the work in general terms, but not in complete detail, it is understood that the item is to be furnished and installed complete and in place and that only the best general practice is to prevail and that only materials and workmanship of the first quality are to be used. Unless otherwise specified, the CONTRACTOR shall furnish all labor, materials, tools equipment and incidentals, and do all the work involved in executing the contract.

SECTION 1 - TERMS, DEFINITIONS, ABBREVIATIONS AND SYMBOLS

1-2 DEFINITIONS

- Agency/City/Owner - City of Rancho Mirage
- Board/Council - Rancho Mirage City Council
- Caltrans - California Department of Transportation
- County - County of Riverside
- Federal - United States of America
- State - State of California
- Engineer - City Engineer or Designated Representative
- Laboratory - The designated laboratory authorized by the City of Rancho Mirage to test materials and work involved in the contract.
- Standard Specifications - Standard Specifications for Public Works Construction (Green Book)

SECTION 2 - SCOPE AND CONTROL OF THE WORK

2-1 AWARD AND EXECUTION OF THE CONTRACT.

(Replace with the following:)

Within ten (10) working days after the date of the Notice of Award, the CONTRACTOR shall execute and return the following contract documents to the AGENCY:

- Contract Documents
- Rancho Mirage Business License
- Faithful Performance Bond
- Payment Bond
- Public Liability and Property Damage Insurance Certificate
- Worker's Compensation Insurance Certificate
- Proposed Construction Schedule
- Source and submittals of all contract materials, including proof of availability

Failure to comply with the above will result in annulment of the award and forfeiture of the Proposal Guarantee. The Contract Agreement shall not be considered binding upon the agency until executed by the authorized AGENCY officials.

A corporation to which an award is made may be required, before the Contract Agreement is executed by the AGENCY, to furnish evidence of its corporate existence, of its right to enter into contracts in the State of California, and that the officers signing the contract and bonds for the corporation have the authority to do so.

2-3 SUBCONTRACTS

The Bidder's attention is directed to the provision in Section 2-3 of the Standard Specifications for the Requirements and Conditions that he must observe in the preparation of the proposal form and the submission of the bid.

REQUIRED LISTING OF PROPOSED CONTRACTORS--In accordance with the subletting and Subcontracting Fair Practices Act, commencing with Section 4100 of the Public Contract Code:

The bidder's attention is directed to other provisions of said Act related to penalties for failure to observe the provisions by using unauthorized Subcontractors or by making unauthorized substitutions.

A sheet for listing Subcontractors, as required, is included in the Bid Proposal.

2-4 CONTRACT BONDS

Both the Faithful Performance Bond and the Payment Bond shall each be for not less than one-hundred percent (100%) of the total contract amount. The Payment Bond shall remain in force until seven (7) months after the date of recordation of the Notice of Completion or Notice of Acceptance. The Faithful Performance Bond shall remain in force until one year after the date of final acceptance of the work.

2-5 PLANS AND SPECIFICATIONS

2-5.1 General (Replace the first paragraph with the following:)

The CONTRACTOR shall maintain a control set of plans and specifications on the project site at all times. All final locations determined in the field, and any deviations from the plans and specifications, shall be marked in red on this control set to show the record conditions. Upon completion of all work, the CONTRACTOR shall return the control set to the Engineer. Final payment shall not be made until this requirement is met.

2-5.3.3 Submittals. [Replace the last two sentences of the first paragraph with the following]:

One (1) original of each product or construction document submittal shall be transmitted to the Engineer, along with a sequentially numbered Submittal Response Form (see Appendix). One (1) photocopy of the submittal shall be returned to the CONTRACTOR with the Submittal Response Form appropriately marked.

2-5.3.3 Submittals. [Add the following]:

Except as otherwise specified herein, the CONTRACTOR shall furnish for approval, within fifteen (15) working days following award of the Contract, all submittals as required on the Plans or in the Specifications. This provision shall not authorize any extension of time for performance of the Contract. The Engineer and Architect will check and approve such submittals, within ten (10) working days from receipt of same, only for conformance with design concept of work and for compliance with information and regulatory documents given in Contract Documents. Work shall be in accordance with approved submittals.

Unless specified otherwise, sampling, preparation of samples, and tests shall be in accordance with the latest standards of the American Society for Testing and Materials.

Samples of materials and/or articles shall, upon demand, be submitted for tests or examinations and consideration before incorporation of same in work started. The CONTRACTOR shall be solely responsible for delays due to submittals not being submitted in time to allow for proper time to make tests. Acceptance or rejection will be expressed in writing. The Engineer shall have sole discretion as to the acceptance or rejection of submittals. Rejection of submittals and any demand for re-submittal for review and approval by the Engineer shall not entitle the CONTRACTOR to additional time or costs caused by the rejection.

Materials furnished must be equal to approved samples in every respect. Samples which are of value after testing will remain the property of the CONTRACTOR.

2-8 RIGHT OF WAY [Add the following]:

The Agency reserves the right to prohibit the CONTRACTOR to work on property where right of way or right of entry has not been obtained prior to issuing the notice to proceed.

2-9 SURVEYING

2-9.1 Permanent Survey Markers

The Contractor shall notify the Engineer, at least 7 days before starting work to allow for the preservation of survey monuments, lot stakes (tagged), and bench marks. The Contractor shall not disturb survey monuments, lot stakes (tagged), or bench marks without the consent of the Engineer. The Contractor shall bear the expense of replacing any that may be disturbed without permission. Replacement shall be done only under the direction of the Engineer by a Registered Land Surveyor or a Registered Civil Engineer authorized to practice land surveying within the State of California.

When a change is made in the finished elevation of the pavement of any roadway in which a permanent survey monument is located, the Contractor shall adjust the monument cover to the new grade within 7 days of finished paving unless otherwise specified in the Special Provisions.

Full compensation for conforming to these requirements shall be considered as included in the various contract items and no separate payment will be allowed therefore.

2-9.2 Surveying Service. [Replace the first two paragraphs with the following]:

The Agency will provide surveying and construction staking required for the construction of this project, consistent with industry standards and as determined by the Engineer.

The cost of any additional surveying and/or construction staking primarily for the convenience of the CONTRACTOR, not in conformance with usual and customary practices, and for replacement of stakes lost as a result of the CONTRACTOR'S operations will be the responsibility of the CONTRACTOR. The cost of said additional surveying shall be deducted from the CONTRACTOR'S progress payments. The CONTRACTOR shall make all requests for construction stakes in writing at least 48 hours in advance of the day required. The CONTRACTOR shall dig all holes necessary for line and grade stakes, or to determine locations of any utility or structure.

The CONTRACTOR shall establish his own finish elevation control from the offset construction staking provided. Payment for setting additional control shall be considered as included in the price bid for the applicable items of work.

If construction staking is provided and subsequently removed, destroyed or impacted, whether accidentally or otherwise, or the CONTRACTOR desires additional staking from the above sets, the CONTRACTOR will be charged for replacement staking and survey control at a fee of \$250.00 per hour (4 hour minimum).

SECTION 3 - CHANGES IN WORK

3-3.1 General (Add the following):

(a) No CONTRACTOR claims for extra work shall be accepted or approved by the Agency that are submitted more than 10 days after the work was performed unless the work has been authorized in writing by the Engineer.

3-3.2.3 Markup (Replace with the following):

(a) **Work by Contractor.** The following percentages shall be added to the CONTRACTOR'S costs and shall constitute the markup for all overhead and profit.

- 1) Labor 15%
- 2) Materials 10%
- 3) Equipment Rental 10%
- 4) Other Items and Expenditures 5%

To the sum of the costs and markups provided for in this subsection, 1 percent shall be added as compensation for bonding.

(b) **Work by Subcontractor.** When a Subcontractor performs all or any part of the extra work, the markup established in 3-3.2.3(a) shall be applied to the Subcontractor's actual cost of such work. **The Contractor may add a markup of 5 percent of the subcontracted portion of the extra work.**

SECTION 5 - UTILITIES

5-1 LOCATION (Add the following paragraphs:)

The CONTRACTOR shall notify the utilities at least 48 hours in advance of excavating around any of their structures.

The existence and locations of utilities shown on the drawings have been determined by a search of the available records as provided by the respective utility owner. The exact locations have not been determined by potholing unless so indicated on the drawings. **The CONTRACTOR shall determine the exact location of all existing utilities prior to commencing work.** He/She agrees to be fully responsible for any and all damages which may be occasioned by his failure to exactly locate and preserve any and all underground utilities, whether shown on the plans or not. **In the event the CONTRACTOR encounters underground utilities not shown on the plans, he/she shall verify the exact location of the utility and immediately notify the Engineer, regardless of whether the unknown utility conflicts with the proposed construction or not.** In the event of such a previously unknown conflict, the CONTRACTOR shall immediately notify the Engineer as to the extent, if any, of delays or additional costs resulting from said conflict.

The CONTRACTOR shall perform work and provide necessary materials to disconnect or relocate existing utilities as indicated. The CONTRACTOR shall document on record drawings all existing utility termination points before disconnecting.

The CONTRACTOR shall protect in place all existing power poles and overhead lines in the work area.

Where underground main distribution conduits such as water, gas, sewer, electric power, telephone, or cable television are shown on the Plans, the CONTRACTOR shall assume that every property parcel will be served by a service connection for each type of utility.

When uncharted or incorrectly charted underground piping or other utilities and services are encountered during site work operations, notify the applicable utility company immediately to obtain procedure directions. Cooperate with the applicable utility company in maintaining active services in operation.

The CONTRACTOR is advised of the existence of the utility notification service provided by UNDERGROUND SERVICE ALERT (USA). USA member utilities will provide the CONTRACTOR with the precise locations of their substructures in the construction area when the CONTRACTOR gives at least 48 hours notice to the Underground Service Alert by calling 1-800-227-2600. CONTRACTOR shall provide the AGENCY with proof of contact with USA upon request.

1. Southern California Gas Company
USA Member Utility, Phone 1-800-422-4133
Protection of existing facilities by Contractor.
2. Southern California Edison Company
Local Telephone (760) 202-4227/4254
USA Member Utility, Phone 1-800-422-4133
Protection of existing facilities by Contractor.
3. Verizon –Telephone
USA Member Utility, 1-800-422-4133
Protection of existing facilities by Contractor.
4. Coachella Valley Water District (Water, Sewer and Flood Control)
USA Member Utility, Phone 1-800-422-4133
Protection of existing facilities by Contractor.
5. Time Warner Cablevision
Local Telephone (760) 340-2225
Protection of existing facilities by Contractor.
6. City of Rancho Mirage, Public Works Department
Local Telephone (760)770-3224
Protection of existing facilities by Contractor.

The California Public Utilities Commission mandates that, in the interest of public safety, main line gas valves be maintained in a manner to be readily accessible and in good operating condition. The CONTRACTOR shall notify the Southern California Gas Company's Headquarters Planning Office at (714) 369-0680 at least two (2) working days prior to the start of construction.

The CONTRACTOR shall exercise extreme care to protect all existing utilities in place whether shown on the plans or not, and shall assume full responsibility for all damage resulting from his operations. The CONTRACTOR shall coordinate with each utility company as to the requirements and methods for the duration of protection, and shall be responsible for preparation and processing of any required plans or permits. The CONTRACTOR shall assume full responsibility to maintain uninterrupted service for all utilities.

By submitting a bid, the CONTRACTOR acknowledges the above referenced utility work to be completed in conjunction with this project. The CONTRACTOR shall schedule his work and conduct his operations so as to permit access and time for the required utility work to be accomplished during the progress of the work.

The CONTRACTOR shall coordinate with each utility company as to the extent of required work and the time required to do so. The CONTRACTOR shall include this time in his/her schedule. Payment for the above, if any, shall be deemed as included in the items of work, and no additional compensation as will be allowed.

5-4 RELOCATION. [Delete the Second and Fourth Paragraphs and add the following paragraph]:

Except as otherwise directed or called out on the approved plans, the alteration or temporary relocation of all service connections (including but not limited to: water, irrigation water, sewer, natural or manufactured gas, underground and/or overhead telephone and electrical) to any adjacent property or landscaped medians shall be the responsibility of the CONTRACTOR. The CONTRACTOR shall restore the service connections immediately after any disruption in service. No attempt has been made to show all service connections on the Plans. The CONTRACTOR shall make all arrangements with the utility owners regarding such work. The costs for such work on service connections, except when specified in the detailed specifications that the utility owners will make no charges for the work, shall be absorbed in the unit prices or included in the lump sum amounts bid for the various other contract items.

SECTION 6 - PROSECUTION, PROGRESS AND ACCEPTANCE OF WORK**6-1 CONSTRUCTION SCHEDULE AND COMMENCEMENT OF WORK**

(Replace with the following):

The CONTRACTOR'S proposed construction schedule shall be submitted to the Engineer within ten (10) working days after the date of the Notice of Award of Contract. The schedule shall be supported by written statements from each supplier of materials or equipment indicating that all orders have been placed and acknowledged, and setting forth the dates that each item will be delivered.

Prior to issuing the Notice to Proceed, the Engineer will schedule a preconstruction meeting with the CONTRACTOR to review the proposed construction schedule and delivery dates, arrange the utility coordination, discuss construction methods, and clarify inspection procedures.

The CONTRACTOR shall submit periodic progress reports to the Engineer by the tenth day of each month. The report shall include an updated construction schedule. Any deviations from the original schedule shall be explained. Progress payments will be withheld pending receipt of any outstanding reports.

6-7 TIME OF COMPLETION**6-7.1 General**

The time for completion shall be as set forth in Paragraph C.3 of the Standard Agreement, Section 00312-2 "Time For Completion", and Paragraph 3, Section 00700-1, "Time For Completion", of the General Conditions.

6-7.2 Working Day

The CONTRACTOR'S activities shall be confined to the hours between 7:00 A.M. and 4:00 P.M., Monday through Friday, excluding holidays. Deviation from these hours will not be permitted without the prior consent of the Public Works Director, except in emergencies involving immediate hazard to persons or property. In the event of unique circumstances, work hours may be extended and may include weekend days at the discretion of the Public Works Director.

In the event of either a requested or emergency deviation where additional time, days or inspectors are deemed necessary, inspection service charges will be charged against the CONTRACTOR. The service charges will be calculated at overtime rates including benefits, overhead, and travel time. The service charges will be deducted from any amounts due the CONTRACTOR.

6-9 LIQUIDATED DAMAGES

(Replace last sentence of the first paragraph and the entire second paragraph with the following):

For each consecutive calendar day in excess of the time specified, as adjusted in accordance with Subsection 6-6, for completion of the work the CONTRACTOR shall pay to the AGENCY, or have withheld from monies due it, the sum of \$1,000.

Execution of the Contract shall constitute agreement by the Agency and CONTRACTOR that \$1,000 per day is the minimum value of the costs and actual damage caused by the failure of the CONTRACTOR to complete the Work within the allotted time. Such sum is liquidated damages and shall not be construed as a penalty, and may be deducted from payments due the CONTRACTOR if such delay occurs.

SECTION 7 - RESPONSIBILITIES OF THE CONTRACTOR**7-1 CONTRACTOR'S EQUIPMENT AND FACILITIES**

A noise level limit of 86 dba at a distance of fifty feet (50') shall apply to all construction equipment on or related to the job whether owned by the CONTRACTOR or not. The use of excessively loud warning signals shall be avoided except in those cases required for the protection of personnel.

7-2 LABOR**7-2.1 Laws**

The CONTRACTOR, and all subcontractors, suppliers and vendors, shall comply with all AGENCY, State, and Federal orders to ensure equal employment opportunities and fair employment practices.

7-3 LIABILITY INSURANCE

(Replace the entire Subsection with the following):

7-3.1 Indemnification

The CONTRACTOR shall indemnify and save harmless the City of Rancho Mirage, the State of California, the County of Riverside, and/or any incorporated city for all claims or suits for damages arising from his/her prosecution of the contract work, as more fully described in Subsection 7-3.2 "Contractor's Liability."

7-3.2 Contractor's Liability

The City of Rancho Mirage, its City Council, or its Engineer, shall not be answerable or accountable in any manner for any loss or damage that may happen to the work or any part thereof; or for any of the materials or other things used or employed in performing the work; or for injury to any person or persons, either workmen or the public; or for damage to adjoining property from any cause which might have been prevented by the CONTRACTOR or his/her workmen or any one employed by him, against all of which injuries or damages to persons and property the CONTRACTOR, having control over such work, must properly guard. The CONTRACTOR shall be responsible for any damage to any person or property resulting from defects or obstructions or any time before its completion and final acceptance, and shall indemnify and save harmless the City of Rancho Mirage, its City Council, and the Engineer from all suits or actions of every name and description brought for, or on account of, any injuries or damages received or sustained by any person or persons, by the CONTRACTOR, his/her servants or agents, in the construction of the work or by or in consequence of any negligence in guarding the same, in improper materials used in its construction, or by or on account of any act or omission of the CONTRACTOR or his agents, and so much of the money due the CONTRACTOR under and by virtue of the contract as shall be considered necessary by the CITY may be retained by the CITY until disposition has been made of such suits or claims for damages aforesaid.

If, in the opinion of the Engineer, the precautions taken by the CONTRACTOR are not safe or adequate at any time during the life of the contract, he may order the CONTRACTOR to take further precautions, and if the CONTRACTOR shall fail to do so, the Engineer may order the work done by others and charge the CONTRACTOR for the cost thereof, such cost to be deducted from any money due or becoming due the CONTRACTOR. Failure of the Engineer to order such additional precautions, however, shall not relieve the CONTRACTOR from his/her full responsibility for public safety.

7-5 PERMITS (Replace the first sentence with the following):

Prior to the start of any work, the CONTRACTOR shall take out the applicable CITY permits and make arrangements for CITY inspections. The CONTRACTOR and all subcontractors shall each obtain any and all other permits, state licenses, CITY Business licenses, inspections, certificates, or authorizations required by any governing body or public utility. The City of Rancho Mirage encroachment permit fee is listed in the Bid Proposal. The permit shall be obtained by the contractor prior to the start of work. Payment for this work shall be included in the bid item of work "Encroachment Permit" and no additional compensation will be allowed.

7-8 PROJECT SITE MAINTENANCE (Add the following):**7-8.1 Cleanup and Dust Control.**

The CONTRACTOR shall read and abide by the requirements set out in the **Local Air Quality Management Plan** attached to the Plans. In particular this has provisions for: control of the site construction dust through **daily watering** of all disturbed areas and/or treatment of said areas with an approved "Dust Palliative" as described under Section 7-9, "Protection and Restoration of Existing Improvements", any requirements for all hauled materials to be appropriately covered with tarps; and a provision for street sweeping to remove sand and dust from traffic zones. Any sandblasting must be done by the "wet" method, and all residues must be cleaned up by street sweepers as soon as possible. Any substance other than water to be used for dust control for this project must be pre-approved by both the Engineer and the Regional Water Quality Control Board.

Costs for maintaining dust control measures, including hydro mulch, fiber and other palliatives during construction and obtaining and applying construction water for dust control shall be paid for in the listed Bid Item "Clearing and Grubbing".

7-8.1.1 Demolition and Construction Material Recycling.

CONTRACTOR shall recycle demolition and construction materials from the job site. For example, asphalt, concrete, metals, glass, and green waste are all recyclable materials. CONTRACTOR shall provide the City with verification, including name and address, of the company hauling the recyclable materials. Weight tickets shall be submitted to the City from the facility receiving the materials.

7-8.6 Water Pollution Control [Not Applicable - SWPPP is not a part of the project]

The CONTRACTOR shall be responsible for complying with all requirements of Caltrans Standard Specifications Section 7-1.01G, "Water Pollution," and the "Caltrans Storm Water Quality Handbook, Construction Contractor's Guide and Specifications," latest edition, for development and implementation of the Storm Water Pollution Prevention Plan (SWPPP). The SWPPP shall also be in full conformance with the latest requirements of the Regional Water Quality Control Board, the Whitewater River Region Storm Water Management Plan (SWMP), the City of Rancho Mirage Local Implementation Plan (LIP), and the project specific requirements of the City Engineer. The most stringent current requirements shall be in effect.

The CONTRACTOR is hereby notified that specific construction practices in the Caltrans Standard Specifications, Section 7, "Responsibilities of the Contractor," are considered to be the Best Management Practices, and are in some cases subject to amendments and updates from regulatory agencies and ordinances. Applicable construction practices in the Standard Specifications and other current relevant sources shall be incorporated into the SWPPP. Additionally, at a minimum, the CONTRACTOR'S work will be in compliance with the Caltrans Statewide National Pollutant Discharge Elimination System (NPDES) Storm Water Permit, Order No. 99-06 DWQ, and NPDES No. CAS000003, adopted by the State Water Resources Control Board (SWRCB) on July 15, 1999, in addition to the BMP's specified in the Caltrans Storm Water Management Plan (SWMP), the Whitewater River Region SWMP, the City of Rancho Mirage LIP and the Regional Water Quality Control Board Permit for Linear Projects. When applicable, the Permittee will also conform to the requirements of the General NPDES Permit for Construction Activities, Order No. 2009-0009-DWQ, NPDES No. CAS000002, and any subsequent General Permit in effect at the time of issuance of this Encroachment Permit.

At the time of the preconstruction meeting the CONTRACTOR must have the SWPPP completed and signed by the responsible parties, and it shall be reviewed and accepted by the City prior to submittal to the Regional Board and the start of any work. The CONTRACTOR shall name himself as the "responsible party" in the permit.

The CONTRACTOR shall be responsible for conducting all required monitoring inspections and shall file original copies of the inspections and all other reports, certifications or records as required by the SWPPP with the City. All fines levied as a result of the CONTRACTOR's failure to comply with the requirements of the SWPPP, shall be the CONTRACTOR's responsibility.

Time extensions will not be allowed for any suspension of work as a result of the CONTRACTOR's noncompliance with the SWPPP.

Payment for preparing and gaining approval of the SWPPP, complying with the SWPPP, and implementation of the SWPPP, shall be included in the other items of work, and no additional compensation shall be allowed.

7-8.7 Drainage Control

Flow, Acceptance and Removal of Water

It is anticipated that storm, surface or other waters will be encountered at various times during the work herein contemplated. The CONTRACTOR, by submitting a bid acknowledges that he/she has investigated the risk arising from such waters and has prepared his/her bid accordingly, and CONTRACTOR submitting a bid, assumes all said risk.

The CONTRACTOR shall conduct his/her operations in such a manner that storm or other existing waters may proceed uninterrupted along their existing street or drainage courses. Diversions of water for short reaches to protect construction in progress will be permitted if public and/or private properties, in the opinion of the Engineer, are not subject to probability of damage. The CONTRACTOR shall obtain written permission from the applicable public agency or property owner before any diversion of water outside of public right-of-way will be permitted.

The CONTRACTOR shall provide and maintain at all times during construction ample means and devices to promptly remove and properly dispose of all water entering the excavations or other parts of the work. No concrete footing or structure shall be laid in water nor shall water be allowed to rise over them until the concrete or mortar has set at least eight (8) hours. Water shall not be allowed to rise unequally against a wall for a period of twenty-eight (28) days. Dewatering for the structures and pipelines shall commence when ground water is first encountered, and shall be continuous until such time as water can be allowed to rise in accordance with the above paragraph. Dewatering shall be accomplished by well points or some other method which will insure a dry hold and preservation of final lines and grade of the bottoms of excavation, all subject to the approval of the Engineer.

7-9 PROTECTION AND RESTORATION OF EXISTING IMPROVEMENTS

If any irrigation facilities are encountered they shall be preserved in place or repaired quickly so no serious disruption in watering takes place.

Restoration of other landscape items shall follow the Standard Specifications except as modified by these Special Provisions. If questions arise about how the finished products should look, the CONTRACTOR should anticipate allowing direction from the residents and the Engineer. If resident requests appear to be beyond the scope of the plans and specifications, the CONTRACTOR shall get written clearance from the Engineer to proceed prior to doing the work. However, the City is not opposed to the CONTRACTOR setting up separate construction agreements outside this contract if they do not interfere with this project. If such "side-jobs" require City Permits, the CONTRACTOR is responsible for getting them prior to the work being done.

At the end of the project, and/or prior to stopping the daily watering routine, all non-traffic disturbed areas shall be sealed with a wood fiber or recycled paper "hydro mulch" containing a natural or chemical binding agent acceptable to the City and the Regional Water Quality Control Board per Caltrans Standard Specifications 20-2.07 "Fiber". Formulations and application should be aimed at stabilizing the soil until such time as native plants re-establish themselves. Alternately, such areas may be treated by seeding them with a grass or flower seed and continuing the watering operations until the plants are at least 2" high.

Fiber shall be produced from natural or recycled (pulp) fiber, such as wood chips or similar wood materials or from newsprint, chipboard, corrugated cardboard or a combination of these processed materials, and shall be free of synthetic or plastic materials. Fiber shall not contain more than 7 percent ash as determined by the Technical Association of the Pulp and Paper Industry (TAPPI) Standard T413, shall contain less than 250 parts per million boron and shall be otherwise nontoxic to plant or animal life.

Fiber shall have a water-holding capacity by mass of not less than 1200 percent as determined by the procedure designated in the Caltrans Final Report, CA-DOT-TL-2176-1-76-36, "Water-Holding Capacity for Hydro mulch," available from the Caltrans Laboratory.

Fiber shall be of such character that the fiber will disperse into a uniform slurry when mixed with water. Water content of the fiber before mixing into slurry shall not exceed 15 percent of the dry mass of the fiber. The percentage of water in the fiber shall be determined by California Test 226. Fiber shall have the moisture content of the fiber marked on the package. Fiber shall be colored to contrast with the area on which the fiber is to be applied, and shall not stain concrete or painted surfaces.

A certificate of Compliance for fiber shall be furnished to the Engineer in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," in the Caltrans Standard Specifications.

The hydro mulch shall have a binder material that is safe for the environment; such as may be created from natural substances like lignin or cellulose, or chemical binders that have been approved by the Regional Water Quality Control Board such as Acrylic Polymer. The binder shall be of sufficient strength when combined with the hydro mulch that weeds will be able to re-establish themselves before the hydro mulch breaks down. An application rate shall be chosen that leaves a layer approximately ¼ inch thick on all surfaces. A neutral colorant (typically green or brown) shall be added to the hydro mulch so that it contrasts slightly with the sand, so that application thoroughness can be readily checked. The colorant shall not stain concrete or other materials that it may come in contact with, and it should be designed to fade after application.

Payment for disturbed area sealant shall be included in the **Lump Sum** unit price bid for Clearing and Grubbing, and no additional payment will be made therefore.

7-10 PUBLIC CONVENIENCE AND SAFETY**7-10.1 Traffic and Access**

When entering or leaving roadways carrying public traffic, the CONTRACTOR'S equipment, whether empty or loaded, shall in all cases yield to public traffic. Construction access shall only be as allowed by the City Engineer and as set forth in these Special Provisions and as shown on the approved Storm Water Pollution Control Plans and the approved Traffic Control Plan.

To the extent possible, access shall be maintained to all properties, businesses and residences by use of temporary ramps and/or detours. Driveway construction shall be phased to allow access during construction. Any closures shall be approved by the City Engineer prior to occurrence.

The CONTRACTOR shall notify all affected property owners of the proposed schedule a minimum of 48 hours, but not more than 72 hours, in advance of any limitation or closure of access to their property. Form of said notice shall be as approved by the Engineer and shall contain the date and time of the closure. In the event of delay, whether beyond the control of the CONTRACTOR or not, the CONTRACTOR shall notify all affected property owners as to the extent of the delay and his revised schedule. In the event of delay over 72 hours, the CONTRACTOR shall re-notify the property owners as described above. Payment for notification and coordination shall be included in the compensation paid for the various items of work and no additional compensation will be allowed.

7-10.1.1 Traffic Control System [Add the following section]:

A traffic control system shall consist of closing traffic lanes in accordance with the current California Department of Transportation California Manual on Traffic Control Devices, Latest Edition.

The provisions in this section will not relieve the CONTRACTOR from his responsibility to provide such additional devices or take such measures as may be necessary to comply with the provisions in Section 7-1.09, "Public Safety," of the Standard Specifications.

The CONTRACTOR shall submit a detailed traffic control plan (for each phase of construction), signed by a Registered Civil Engineer, to the City of Rancho Mirage 15 days prior to start of construction.

All traffic signals shall remain in operation during the entire construction period. Any temporary modification of existing traffic signals shall be approved by the ENGINEER.

The CONTRACTOR shall furnish, install and maintain temporary construction signs, delineators, barricades, and other safety devices that are clean, in good condition, and are highly reflective as required for public safety as or directed by the ENGINEER. Attention is directed to Section 7, "Responsibilities of the CONTRACTOR" of the Standard Specifications and these Special Provisions. This work shall conform to the Standard Specifications, these special provisions and the APWA "Work Area Traffic Control Handbook" (Watch Manual). This includes but is not limited to:

- A. Mobilization
- B. Furnish, install and maintain temporary signs, flashers, barricades, delineators, etc.
- C. Remove temporary facilities upon completion of the project.

CONTRACTOR shall notify adjacent businesses 48 hours prior to construction that will provide limited access to their business. Access to existing businesses shall be maintained at all times outside of working hours.

CONTRACTOR shall provide access to all existing bus stop locations outside the travel way. Any deviations requirements shall be approved by Sunline Transit Agency and shall be submitted to the CITY for approval.

Each vehicle used to place, maintain, and remove components of a traffic control system shall be equipped with a Type II flashing arrow sign which shall be in operation when the vehicle is being used for placing, maintaining, or removing said components. The sign shall be controllable by the operator of the vehicle while the vehicles in motion. The flashing arrow sign shown on the plans shall not be used on the vehicles which are doing the placing, maintaining, and removing of components of a traffic control system, and shall be in place before a lane closure requiring its use is completed.

If any component in the traffic control system is displaced, or ceases to operate or function as specified, from any cause, during the progress of the work, the CONTRACTOR shall immediately repair said component to its location.

When lane closures are made for work periods only, at the end of each work period, all components of the traffic control system, except portable delineators placed along open trenches or excavation adjacent to the traveled way, shall be removed from the traveled way and shoulder. If the CONTRACTOR so elects, said components may be stored at selected central locations, approved by the ENGINEER, within the limits of the highway right of way.

7-10.1.2 Payment

Full compensation for providing the **Traffic Control** system (including signs) shall be considered as included in the various items of work and no additional payment will be made thereof.

7-10.2 Storage of Equipment and Materials in Public Streets. [Add the following]

The CONTRACTOR may, at his/her own expense, maintain and operate a work and storage area outside of the public right-of-way. In such case the CONTRACTOR shall submit to Agency written authorization from the owners of the subject property prior to occupation. Occupation of site without written authorization shall be grounds for immediate suspension of work. The Location of site is to be approved by Agency prior to usage. Condition and operation of yard shall conform to these specifications. The CONTRACTOR shall assume full responsibility for all damage to the site resulting from his/her operations and shall repair and or replace same at his/her own expense to the satisfaction of the owner of the subject property. The CONTRACTOR shall vacate site and clean it and seal it with a "hydro mulch" or fiber per Section 7-9, "Protection and Restoration of Existing Improvements" noted above and as approved by the City Engineer within five (5) working days following application for Notice of Completion. The CONTRACTOR shall obtain a written release from the property owner specifying the condition of the vacated site and releasing the CONTRACTOR from any further clean-up or restoration work and shall submit a copy of such release to Agency. The Notice of Completion will not be issued until said release is submitted. Work areas and storage areas shall be included in and subject to the project Storm Water Pollution Prevention Plan (SWPPP).

Payment for the performance of any work, use or lease of property, maintenance and cleanup during occupation and following completion of all work shall be included in the compensation paid for the various items of work, and no additional compensation will be allowed.

7-10.3 Street Closures, Detours and Barricades. [Add the following]:

The CONTRACTOR shall maintain the minimum traffic requirements designated in the General Conditions.

No street or access closure to through traffic will be allowed without the express approval of the Agency.

The CONTRACTOR shall be responsible for providing temporary access to all driveways at the end of each work day and as much as possible during the construction day.

The CONTRACTOR shall provide and maintain all other signs, barricades pedestals, flashers, delineators and other necessary facilities for the protection of the public within the limits of the construction area. The CONTRACTOR shall also post proper signs to notify the public regarding detours and the condition of the roadway, all in accordance with the provisions of the Vehicle Code and the current California Department of Transportation California Manual on Traffic Control Devices, 2009 Edition. Should the CONTRACTOR appear to be neglectful or negligent in furnishing warning and protective measures as provided, the Engineer may direct attention to the existence of a hazard and the necessary warning and protective measures shall be furnished and installed by the CONTRACTOR at his expense. Should the Engineer point out the inadequacy of warning and protective measures, such action on the part of the Engineer shall not relieve the CONTRACTOR from responsibility for public safety or abrogate his obligation to furnish and pay for these devices.

When lane closures are made for work periods only, at the end of each work period, all components of the traffic control system, except portable delineators placed along open trenches or excavation adjacent to the traveled way, shall be removed from the traveled way and shoulder. If the CONTRACTOR so elects, said components may be stored at selected central locations, approved by the Engineer, within the limits of the highway right of way.

Full compensation for conforming to this article shall be considered as included in the various items of work involved, and no additional compensation will be allowed therefore.

All existing stop signs, street name signs and regulatory signs shall be maintained in visible locations during construction and permanently relocated or removed as directed by the plans and the Engineer.

7-10.4.1 Safety Orders. [Add the following paragraph]:

The CONTRACTOR shall comply with the provisions of any Agency ordinances or regulations regarding requirements for the protection of excavations and the nature of such protection.

7-10.5 Truck Haul Route. [Add as a new section]:

A truck haul route plan will be prepared and submitted to the City Engineer for all trucks transporting materials to and from the project site.

7-10.5.1 General Requirements. [Add as a new section]:

A Proposed truck haul route is to be submitted to the City Engineer's office for review. Upon approval, an approved copy shall be returned to the CONTRACTOR. The CONTRACTOR shall post an approved copy on the job site. All trucks working that project shall also carry a copy. If a truck is found not to be carrying an approved copy, the CONTRACTOR shall be subject to a Notice of Noncompliance (stop work order).

All trucks must cover the dirt with an acceptable tarp during transport for dust containment. Provisions for street sweeping and watering will also be required unless an active wheel washing facility proves that they are unnecessary to the satisfaction of the City Engineer.

All truck haul routes, as approved, are good only for the project time period, and trucks shall have to comply with the approved route only. If during the progress of the project an alternate route is needed, the CONTRACTOR shall submit a new plan. The haul route application shall contain the following information:

1. Map showing the proposed route
2. Project name
3. Owner's name, address and phone number
4. Grading Contractor's name, address and phone number
5. Type of material being hauled
6. Tract or Project Number involved
7. Grading, construction or Encroachment Permit number.

7-11 DISPUTE RESOLUTION

For any claim of three hundred seventy-five thousand dollars (\$375,000) or less which arise between CONTRACTOR and the CITY, the following dispute resolution procedures shall apply, pursuant to Section 20104 *et seq.* of the Public Contract Code:

1. CONTRACTOR must file a claim in writing and include the documents necessary to substantiate the claim. The claim must be filed on or before the date of final payment.
2. For claims of less than fifty thousand dollars (\$50,000), the CITY shall respond in writing to any written claim within 45 days of receipt of the claim, or may request, in writing, within 30 days of receipt of the claim, any additional documentation supporting the claim or relating to defenses to the claim the CITY may have against CONTRACTOR.
 - a. If additional information is thereafter required, it shall be requested and provided, upon mutual agreement of the CITY and CONTRACTOR.
 - b. The CITY's written response to the claim, as further documented, shall be submitted to CONTRACTOR within 15 days after receipt of the further documentation or within a period of time no greater than that taken by CONTRACTOR in producing the additional information, whichever is greater.
3. For claims of over fifty thousand dollars (\$50,000) and less than or equal to three hundred seventy-five thousand dollars (\$375,000), the CITY must respond in writing to the claim within 60 days of receipt of the claim, or may request, in writing, within 30 days of receipt of the claim, any additional documentation supporting the claim or relating to defenses to the claim the CITY may have against CONTRACTOR.
 - a. If additional information is thereafter required, it shall be requested and provided, upon mutual agreement of the CITY and CONTRACTOR.
 - b. The CITY's written response to the claim, as further documented, shall be submitted to CONTRACTOR within 30 days after receipt of the further documentation, or within a period of time no greater than that taken by CONTRACTOR in producing the additional information or requested documentation, whichever is greater.
4. If CONTRACTOR disputes the CITY's written response, or the CITY fails to respond within the time prescribed, CONTRACTOR may so notify the CITY, in writing, either within 15 days of receipt of the CITY's response or within 15 days of the CITY's failure to respond within the time prescribed,

respectively, and demand an informal conference to meet and confer for settlement of the issues in dispute. Upon a demand, the CITY shall schedule a meet and confer conference within 30 days for settlement of the dispute.

5. Following the meet and confer conference, if the claim or any portion remains in dispute, CONTRACTOR may file a claim as provided in Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of Title 1 of the Government Code.
6. If the meet and confer conference does not successfully resolve all disputes, CONTRACTOR may file an action under Section 20104.4 of the Public Contract Code (after compliance with the procedures required by the Government Code) after which time the parties must first submit to non-binding mediation unless mutually otherwise stipulated.
7. If mediation is not successful in resolving all disputes under Section 20104.4, the parties must submit to arbitration.
8. After arbitration, either party may request a trial de novo but if that party does not receive a more favorable judgment than that obtained in the arbitration, it shall pay attorney's fees and costs of the other party arising out of the de novo trial.

SECTION 9 - MEASUREMENT AND PAYMENT**9-1 MEASUREMENT OF QUANTITIES FOR UNIT PRICE WORK****9-3.2 Partial and Final Payment** (Replace the last paragraph with the following):

The closure date for periodic progress payments shall be five (5) working days prior to the first Monday of each month. The final progress payment shall not be released until the CONTRACTOR returns the control set of plans and specifications showing the record conditions, and provides any other documentation or submittals required by these specifications.

The full five percent (5%) retention shall be deducted from all payments. The final retention shall be authorized for payment thirty-five (35) days after the date of recordation of the Notice Completion and Acceptance of the work.

In conformance with the State of California Public Contract Code Part 5, Section 22300, the CONTRACTOR may substitute securities for any monies withheld by the CITY to ensure performance under the contract.

9-3.3 Delivered Materials (Replace with the following):

Materials and equipment delivered but not incorporated into the work will not be included in the estimate for progress payment, subject to the discretion of the Engineer.

9-3.4 Mobilization (Replace with the following):

Mobilization shall consist of preparatory work and operations, including but not limited to those necessary for the movement of personnel, equipment, supplies and incidentals to the project site; for the establishment of all portable offices, buildings and other facilities necessary for the work on this project; and for all other work and operations which must be performed or cost incurred prior to beginning work on the various contract items on the project site.

Mobilization shall also include, but not be limited to, temporary power, construction water (including meter acquisition and fees), scheduling, progress reports, invoicing, permits (except as otherwise provided in these specifications), staging areas, special inspection, mobilizing equipment, personnel and materials, and all other indirect costs associated with completing the work and not covered or compensated under relevant bid items.

The compensation paid for mobilization shall be included in accordance with the Standard Specifications and paid for under the **lump sum** bid item and shall be full compensation for all costs incurred by the CONTRACTOR for doing all the work involved in mobilization as specified herein. Payment for mobilization will be included with the first month progress payment and shall be considered full compensation for the cost of such mobilization and administered for the entire contract period.

00 800 SP14 PART 2 - CONSTRUCTION MATERIALS

(Note: This abbreviated list of materials is supplemental to all other related sections of the performance specifications)

SECTION 200 - ROCK MATERIALS

200-1 ROCK PRODUCTS

200-1.1 General.

Crushed Aggregate Base shall be per Section 26, Class 2 Aggregate Base, of the State Standard Specifications (Caltrans), ¾" maximum.

Subsection 26-1.02A "Class 2 Aggregate Base," of the Caltrans Specifications, shall be revised to include the following:

"Disintegrated granite, glass, porcelain, brick, wood, steel (reinforcing nails, etc.) or slag shall not be used for aggregate base. If any detrimental material or deleterious substance is found in the base material, it shall be cause for rejection and be removed from the site."

"Grading or blending of the material shall be done through a screening process."

Subsection 26-1.04, "Spreading" of the Caltrans Specifications, shall be revised to include the following:

"Tailgate spreading by dump truck will not be permitted except for spot dumping and in areas not readily accessible to spreading equipment."

SECTION 201 - CONCRETE, MORTAR, AND RELATED MATERIALS

201-1 PORTLAND CEMENT CONCRETE

201-1.1 Requirements

201-1.1.2 Concrete Specified by Class (Add the following as minimums for this project:)

Construction	Concrete	Maximum
	Class	Slump

Street surface improvements

(curb and gutter, curb, gutter, drive approach,

spandrels, cross gutters):	560-C-3250	4"
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Sidewalks, and access ramps	560-C-3250	4"
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Concrete surrounding manhole, cleanouts, and vault frames.	560-C-3250	4"
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201-1.2 Materials

201-1.2.1 Portland Cement

The cement to be used or furnished shall be Type V Portland Cement conforming to ASTM C150, unless otherwise specified.

Portland Cement Concrete for structures shall conform to the provisions in Section 201 of the Standard Specifications except as modified herein.

All cast in place concrete structures shall be cured by the water method except where curing compound method is approved by the Engineer.

201-1.2.4 Chemical Admixtures (Add the following)

Admixtures may be used by the CONTRACTOR if approved by the Engineer and shall conform to Section 201-1.2.4 - Admixtures.

201-1.2.5 Fly Ash (Add the following)

Fly ash shall not be used in the concrete for this project.

SECTION 203 - BITUMINOUS MATERIALS

203-6.1 General. [as required for patching, repairs, and additions to the existing facilities; add the following to the end of the subsection]

Asphalt concrete shall conform to the provisions of Subsection 400-1, "Rock Products," and Subsection 400-4, "Asphalt Concrete", except shall be in accordance with the Caltrans Aggregate Grading Requirement and performance grade as indicated.

The following aggregate size and performance grade of paving asphalt shall be used.

Asphalt Base Course	¾" Max., Medium	PG 70-10
Leveling and Final Course	½" Max., Medium	PG 70-10

The CONTRACTOR shall submit final asphalt mix designs to the Agency for review prior to paving.

SECTION 211 - MATERIAL TESTS

211-1.1 Laboratory Maximum Density. [Replace with the following]:

Laboratory maximum density tests shall be performed in accordance with Test Method No. Calif. 216G, Part II. The correction for oversized material as stated in Test Method No. Calif. 216 shall be replaced with Note 2 of ASTM D1557.

211-1.2 Field Density. [Add the following Paragraph]:

The Engineer will make field density tests during the course of construction at the expense of the Agency. If field density tests indicate that any portion of the compacted subgrade has density lower than that specified, the CONTRACTOR shall rework that portion until the specified density is obtained. Retest of areas which have failed compaction will be performed by the Engineer at the CONTRACTOR'S expense.

SECTION 214 – TRAFFIC STRIPING, CURB AND PAVEMENT MARKINGS, AND PAVEMENT MARKERS

214-1 General [As necessary and required as replacement due to damage; Add the following]:

Raised pavement markers shall conform to the provisions in Section 82, "Markers and Delineators," of the State Standard Specifications and these special provisions.

All reflective raised pavement markers shall be Apex Universal Inc., Model 921AR (No Equal).

Raised Reflective Pavement Markers at fire hydrants shall be Type-I two-way blue reflective markers conforming to the requirements to section 214-6 of the Standard Specifications.

Raised Reflective Pavement Markers shall be installed with Henry HE184 Flexible Dot Stick Adhesive.

214-4 Paint for Striping and Markings

214-4.1 General. [As necessary and required as replacement due to damage; Add the following]:

Paint for traffic striping and marking shall conform to Caltrans Specification 84-3.

Materials - Materials shall conform to the provisions in Section 84- "Materials," of the State Standard Specifications and these Special Provisions and contained on the list of "pre-qualified and tests signing and delineation materials".

Painted striping shall have a minimum of two coats.

Paint and glass beads shall conform to the following State Specifications:

<u>Paint</u>	<u>State Specifications No.</u>
Rapid Dry water borne white,	
Yellow and black	8010-91D-30
Glass beads	8010-11E-22 Type 11

214-5 Thermoplastic Material for Traffic Striping and Markings. [Add the following]:

214-5.1 Thermoplastic materials shall conform to the provisions in Section 84-2.02 “Materials” of the State Standard Specifications and these Special Provisions and as contained on the list of “pre-qualified and tests signing and delineation materials.”

214-5.1.1 Scope. [Add the following section]:

This specification covers a reflectorized pavement striping material of the type that is applied to the road surface in a molten state by “SCREENED/EXTRUSION” means with a surface application of glass beads at a specified rate. Upon cooling to normal pavement temperature, the material produces an adherent reflectorized stripe of specified thickness and width, capable of resisting deformation by traffic.

214-5.1.2 Materials. [Add the following section]:

The Thermoplastic material shall be available in white, yellow and black.

The thermoplastic material shall be homogeneously composed of pigment, fillers, resins and glass reflectorizing spheres. The vendor shall have the option of formulating the material according to his own specifications. However, the solid resin shall be “maleic-modified glycerol ester resin” (alkyd binder). The physical and chemical properties, as specified below, shall apply regardless of the type of formulation.

Glass beads shall be uncoated and conform to AASHTO M247-81 Type 1.

The thermoplastic material shall not deteriorate on contact with sodium chloride, calcium chloride or other de-icing chemicals or because of oil content of paving materials or oil droppings.

214-5.1.3 Requirements of the Thermoplastic Mixture. [Add the following section]:

The Specific Gravity of the white and yellow thermoplastic traffic line material shall not exceed 2.15.

The pigment, beads and fillers shall be uniformly dispersed in the resin. The material shall be free from all skins, dirt and foreign objects and shall comply with the requirements according to the table below.

COMPOSITION (Percent by Weight)

COMPONENT	WHITE	YELLOW	BLACK
Binder – See Note (b)	18.0 min.	18.0 min.	18.0 min.
Glass Beads	30-40 min.	30-40 min.	0.0 max
Titanium Dioxide	10.0 min.	-----	0.0 max.
Calcium Carbonate & Inert Fillers	42.0 max.	50.0 max.	52.0 max.
Yellow and Black Pigments	-----	See Note (a)	See Note (a)

Note (a) Amount of yellow and black pigment, calcium carbonate and inert fillers shall be at the option of the manufacturer, providing that all other requirements of this specification are met.

Note (b) Alkyd binder shall consist of a mixture of synthetic resins, at least once of which is solid at room temperature, and high boiling point plasticizers. At least one-third of the binder composition shall be solid aleic-modified glycerol ester resin and shall be no less than 8 percent by weight of the entire material formulation. The binder shall not contain petroleum based hydrocarbon resins.

The color of the thermoplastic material, after heating for four hours + five minutes at 425 + 3 (218 + C) underagitation, shall meet with the following requirements:

White: Daylight reflectance at 45 degrees – 0 degrees – 75% minimum.

Yellow: Daylight reflectance at 45 degrees – 0 degrees – 45% minimum.

(For highway use, the yellow color shall reasonably match Color Chip Number 13538 of the Federal Standard Number 595 – Test performed at 77F)

Set Time. When applied at a temperature range of 412.5 + 12.5F (211 + 7C) and thickness of 0.060 to 0.125 inch (1.524 to 4.736 mm), the material shall set to bear traffic in not more than 2 minutes.

214-6 Pavement Markers

214-6.1 Types of Markers [Replace the following section]:

The description, type of markers, sampling, tolerances, packaging, and storage of non-reflective and reflective pavement markers shall be as specified in CALTRANS Specification Section 85 "Pavement Markers". The description, sampling, testing, packaging, labeling and storing of epoxies shall be as specified in CALTRANS Specification Section 95 "Epoxy".

214-6.7 Measurement and Payment. [Add the following section]:

Payment for all of the items of work noted above will be paid from the contract **lump sum** price bid. The price bid shall be considered to include full payment for all materials, labor, equipment and incidentals required to construct the improvements in accordance with the Plans and Specifications, and no additional compensation will be made therefore.

00 800 SP20 PART 3 - CONSTRUCTION METHODS**SECTION 300 - EARTHWORK****300-1.1 General.** [Add the following]:

Miscellaneous

1. CONTRACTOR shall supply and apply an approved soil sterilant prior to installing new paving.
2. CONTRACTOR shall protect existing asphalt concrete pavement within the travelways of the project streets unless specifically indicated to be removed. The CONTRACTOR shall exercise extreme care with his operations so as to not damage the existing pavement. The CONTRACTOR shall repair, at his own expense, all pavement deemed solely by the Agency to have been damaged during the project by the CONTRACTOR.
3. CONTRACTOR shall be responsible for the removal and replacement in kind of all disturbed landscape irrigation and electrical lighting systems and the removal and disposal of any and all trees/landscaping necessary to complete the planned improvements shown or not shown on the plans. Existing irrigation facilities are to be plugged by the CONTRACTOR until the replacement system is constructed. To ensure the remainder landscaping irrigation still functions as it exists, temporary facilities will be constructed at the CONTRACTOR'S expense to allow the protection of the existing foliage. Palm trees that are designated to be removed shall be disposed of by the CONTRACTOR.
4. CONTRACTOR shall protect pipelines, curbs, sidewalks, pavements and facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by the demolition operations. Any damage to existing improvements shall be replaced in kind as approved by the Engineer at the CONTRACTOR'S own expense.
5. Complete compliance with the Local Air Quality Management Plan (LAQMP) for this project, and all other items of work as directed in these Special Provisions. The CONTRACTOR shall be responsible for the procurement and application of a City approved "hydro mulch" dust palliative. The City PM10 ordinance and local water quality control Best Management Practices. The CONTRACTOR shall place this approved "hydromulch" on all unimproved areas which have been disturbed by their operations. Unimproved areas shall include as a minimum the disturbed areas behind the curb and gutter and the select fill areas within the raised median islands.
6. CONTRACTOR shall provide for watering, including developing a water supply and furnishing and placing all water required for work done in the contract, including water used for extra work. CONTRACTOR shall obtain a temporary water meter or supply.
7. CONTRACTOR shall protect existing utilities, paving, curb and gutter, plant material, and irrigation not indicated on plans to be removed or otherwise made known to the CONTRACTOR prior to or during demolition work. If damaged, immediately notify the Agency's Representative. If existing active facilities encountered are not indicated or otherwise made known to the CONTRACTOR and require protection or relocation, the CONTRACTOR shall be responsible for taking whatever immediate steps are necessary to ensure that the service provided is not interrupted. If services are interrupted as a result of the CONTRACTOR'S operation, immediately notify the Agency's Representative. If existing utilities are found to interfere with the permanent facilities under construction under this Contract, immediately notify the Agency's Representative, in writing, requesting instructions on their disposition. Do not proceed until written instructions are received from the Agency's Representative.
8. CONTRACTOR shall be responsible for cleanup of the job site. CONTRACTOR shall leave the site in a clean and orderly manner. This item shall also be interpreted to include the removal or relocation of any additional items not specifically mentioned herein or covered by specific bid item, which may be found within the work limits whether shown or not shown on the plans to be removed or relocated.
9. Measurement and payment for all of the items of work noted above and for the supply and application of any AGENCY approved material shall be included in the CONTRACTOR'S bid and no additional compensation shall be allowed.

300-1.3.2(a) [Add the following]:

Removal of bituminous pavement shall be made to a sawcut at the designated lines of removal shown on the Plans or as designated by the Engineer. A wheel cut may be used at the discretion of the Engineer. Location of sawcut and width of existing pavement to be removed shall be as shown on the plans or as determined by the Engineer in the field. Minimum laying depth of new pavement material shall be 0.12 foot at join lines.

The areas and quantities shown on the plans or specifications are given only for the CONTRACTOR'S aid in planning the work and/or preparing bids. The Engineer shall designate the limits to be removed and these designated areas shall be considered to take precedence over the areas shown on the plans. No guarantee is made that areas or quantities shown will equal the areas or quantities designated by the Engineer. Spalled or loose blocks of pavement and pavement cracks wider than 3/8 inch will be deemed justification for extending or adding to the removal and replacement of asphalt concrete pavement.

The areas indicated for removal and replacement shall be excavated to the full depth of the proposed pavement section (asphalt and base), or as shown on the plans, regardless of thickness.

300-1.4 Payment. Compensation for **Clearing and Grubbing** shall be paid for at the lump sum contract price and no additional compensation will be allowed. Payment shall include full compensation for furnishing all labor, materials, tools, equipment, and doing all work involved in clearing and grubbing as specified. Payment for removal of bituminous pavement and base will be paid in the lump sum bid. Existing curb and gutters, sidewalks, and other items of removal necessary for construction of the improvements will be considered included in the lump sum bid.

300-2 UNCLASSIFIED EXCAVATION

Payment for unclassified excavation shall be included in the compensation paid for the various items of work and no additional compensation will be allowed.

300-4 UNCLASSIFIED FILL

300-4.1 General.

Unclassified Fill shall be placed to the lines and grades shown on the plans, incorporated exhibits or detail drawings and in accordance with the methods of Section 300-4 of the Standard Specifications. Median islands, once constructed, shall be filled to four (4) inches below top of curb. **Any imported soil for the median island fill must have a soil test conducted to verify agricultural suitability.**

Soil testing for agricultural suitability will include but is not limited to the following analysis: soil ph; EC; Boron, Calcium and Magnesium content and N, P, and K levels. A minimum of one composite sample will be taken for every five acres.

Payment for unclassified fill shall be included in the compensation paid for the various items of work and no additional compensation will be allowed.

SECTION 301 TREATED SOILS, SUBGRADE PREPARATION AND PLACEMENT OF BASE MATERIALS

301-1 SUBGRADE PREPARATION.

Preparation of the pavement subgrade shall conform to the provisions of Section 301-1 of the Standard Specifications and these provisions.

301-1.3 Relative Compaction. [Add the following]:

Exposed subgrade to receive new pavement shall be scarified to a depth of 4", moisture conditioned, and re-compacted. The top 12" of subgrade under pavement shall be compacted to 95% relative compaction.

301-1.3 Payment. Compensation for subgrade preparation shall be deemed to be included in the bid price of other items, and no additional compensation will be allowed.

301-2 UNTREATED BASE**301-2.1 General.** [Add the following]:

Untreated base material shall conform to Section 200-1.1 of these specifications.

Preparation of the pavement subgrade shall conform to the provisions of Section 301-1 of the Standard Specifications and these provisions.

301-2.3.1 Compacting. [Add the following]:

Aggregate Base shall be compacted to 95% relative compaction.

301-2.4 Measurement and Payment. [Add the following]:

Payment for **Aggregate Base** shall be included in the contract price. Payment shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals and all work involved in subgrade preparation, scarification, and compaction, and placement of untreated base and no additional compensation will be allowed therefore.

301-6 SOIL STERILANT. [Add the following sections]:**301-6.1 General.**

All areas indicated on the Plans to receive P.C.C., stamped concrete or Asphalt Concrete Pavement over base material shall be prepared in accordance with applicable sections of the Standard Specifications concerning subgrade preparation. In addition, after the compaction is completed, the CONTRACTOR shall apply a soil sterilant to the subgrade. Application shall be by spray equipment which provides good mechanical agitation and even coverage of the area to be treated. Spray equipment shall be calibrated before material is applied, and the Engineer's decision as to the effectiveness of the spray equipment shall be final. Great care shall be taken to apply soils sterilant to the designated areas only. Concrete or asphalt may be placed immediately after placement of soil sterilant.

301-6.2 Operator's License.

The CONTRACTOR'S operator applying the soil sterilant shall be licensed by the State of California, Department of Food and Agricultural Affairs and registered with the Office of the Agricultural Commissioner of Orange County as a pest control officer.

301-6.3 Application.

Any soil sterilant, which is approved in writing by a licensed pest control advisor (for the purpose to which it will apply) may be used upon acceptance by the Engineer. The dye shall not stain concrete or masonry. Certification shall be furnished to the Engineer showing the purchase receipt and manufacturer's recommended rate of application of the material.

301-6.4 Payment.

The CONTRACTOR shall supply all labor, materials and equipment to apply the soil sterilant and shall include the cost for application in the lump sum bid.

SECTION 302 - ROADWAY SURFACING**302-5 ASPHALT CONCRETE PAVEMENT****302-5.2.1.1 Localized Full Depth Pavement Repair** [Add the following section]:

Full depth Pavement Repair shall be done in the areas indicated in the project plans prior to overlay and shall consist of the sawcut and removal of the full AC pavement section, scarification and recompaction of the top 4" of base material, and placement of Asphalt Concrete to existing finish surface.

302-5.2.3 Removal and Disposal of Material [Add the following]:

Removal shall consist of planing and cutting the pavement where indicated and removing loosened material. No aggregate shall remain on the project at the end of each work day. Aggregate material loosened and directed removed shall become the property of the CONTRACTOR and shall be disposed of off the site in accordance with Subsection 300-2.6 as amended by these Special Provisions.

The CONTRACTOR shall divert from the landfill all Portland Cement Concrete material and Asphalt Grindings removed from this project. The CONTRACTOR shall keep accurate weight tickets for material removed from this project to be reused as recycled material. Copies of weight tickets shall be provided to the City.

302-5.4 Tack Coat [Replace with the following]:

Prior to paving over existing asphalt concrete, the surface shall be cleaned, cracks shall be sealed as shown below, and the surface shall have a tack coat of SS-1h emulsion at a rate of 0.10 gallon per square yard applied. The surface shall be free of water, foreign material, or dust, when the tack coat is applied. To minimize public inconvenience, no greater area shall be treated in any one day than is planned to be covered by asphalt concrete during the same day unless otherwise authorized by the Engineer.

A similar tack coat shall be applied to the surface of any course if the surface is such that a satisfactory bond cannot be obtained between it and the succeeding course. The contact surfaces of all cold pavement joints, curbs, gutters, and manholes shall be painted with grade SS-1h emulsified asphalt immediately before the adjoining asphalt concrete or ARHM is placed.

All pavement cracks 1/8" to 1" in width shall be cleaned with a heat lance and sealed with crafcopolyflex type III crack sealant, or approved equal. Crack sealant shall be applied with a wand such that finish surface of the crack seal shall be left 1/4" low in the crack with no sealant at the surface. All cracks 1" or greater shall be cleaned with compressed air and broom to remove all loose material from the crack. Asphalt emulsion tack coat shall be applied to the crack faces. The CONTRACTOR shall fill the crack with 1/2" maximum medium hot mix and tamp. Any voids beneath the pavement must be filled with compacted hot mix prior to the asphalt overlay. Finish surface of the crack seal shall be flush with the surface in preparation of the asphalt overlay.

Payment for crack sealing, patching and tack coating shall be included in the lump sum bid and shall include full compensation for all labor, materials, tools, and equipment and for doing all work involved in crack sealing, patching, and tack coating, complete in place.

302-5.5 Distribution and Spreading. [Add the following]:

The base course, final course, and overlay shall be in conformance with Section 203-6.1 of these specifications.

At those locations where new asphalt concrete pavement joins existing asphalt pavement, the CONTRACTOR shall provide by cold milling or cold planning a 0.125' minimum header cut such that a butt joint can be achieved. No "feathering" or overlay of asphalt less than 0.125' will be allowed.

The Asphalt Concrete delivered to the site during paving operations may be deposited from bottom-dump trucks into a uniformly sized windrow, then pick up the material and convey it to the spreading machine with loading equipment provided that all Greenbook requirements are met.

302-5.8 Manholes (and other structures). [Add the following]:

Adjustment of Sewer Manholes, Cleanouts and Water Valve Covers

All water valve covers and manhole covers shall be lowered by the Contractor prior to paving, and will be raised after paving is completed by Coachella Valley Water District.

~~The raising to grade of sewer and water valve covers, as shown on the plans, shall conform to Section 302-5.8 except that the methods and materials used to perform said work shall be performed in conformance with CVWD Standard Drawing #W-17A and S-1B included in the Appendix of these specifications.~~

Water valves shall be protected in a place and shall be accessible at all times during construction.

The CONTRACTOR shall notify the Coachella Valley Water District forty-eight (48) hours prior to beginning of work.

Other Utility Vaults and Valves

The CONTRACTOR shall check with the utility companies shown in Section 5-1 to confirm whether the CONTRACTOR is responsible for readjusting vault covers and valves or if it is to be done by the utility company. If such facilities must be lowered for the CONTRACTOR to prepare the roadway, the CONTRACTOR shall make any arrangements for the utility company to temporarily lower and place suitable steel plates and/or caps over said facilities. The time for such preparation should be included in the CONTRACTOR'S scheduling. For emergency purposes, gas valves shall be kept readily accessible at all times. **Payment for any such utility preparation shall be included with the lump sum bid.**

302-5.9 Measurement and Payment. [Add the following]:

Payment shall be made at the contract lump sum bid and shall include full compensation for all labor, materials, tools, and equipment and for doing all work involved in placing asphalt concrete, complete in place.

Lower Water Valve Covers and Manhole Covers including all appurtenant work, shall be included in the bid price of other items, and no additional compensation is allowed therefore.

SECTION 303 - CONCRETE AND MASONRY CONSTRUCTION**303-1 CONCRETE STRUCTURES.****303-1.1 General.** [Add the following paragraphs]:

Catch Basin and Local Depression shall conform to the provisions of the Standard Specifications as modified herein.

Reinforcing steel shall be Grade 60 billet steel conforming to ASTM A615.

Catch Basins and Local Depressions shall be constructed in accordance with the provisions of Section 303-1 Concrete Structures of the Standard Specifications.

303-1.11 Payment. [Add the following]:

Payment for concrete structures shall be made at the contract lump sum bid price and shall include full compensation for providing this item of work, complete in place, including structure excavation, structure backfill, reinforcing, forming, finishing, drainage and filter material, and all provisions of the standard plans as depicted in the contract documents and no additional compensation will be allowed.

303-3 CONCRETE CURBS, WALKS, GUTTERS, CROSS GUTTERS, MEDIAN NOSE DETAIL, ACCESS RAMPS AND DRIVEWAYS**303-3.1 General.** [Add the following paragraph]:

Concrete curbs, walks, gutters and driveways shall conform to the Standard Specifications as modified herein.

303-3.2 Gutter. [Add the following]:

Prior to acceptance of the curb and gutter constructed by the CONTRACTOR, a flow test shall be conducted by the CONTRACTOR in the presence of the Engineer. Any new work found to be defective shall be repaired or replaced by the CONTRACTOR in accordance with Subsection 303-5.7 of the Standard Specifications.

303-3.3 Measurement and Payment. [Add the following to this section]:

Payment for Curb, Curb and Gutter, Sidewalks, Drive Approaches, Access Ramps, Parkway Drains, and Cross Gutters with Spandrels shall be made at the contract lump sum bid price and shall include full compensation for providing this item of work, complete in place, and no additional compensation will be allowed. The integral/monolithic curb on curb returns at cross gutters/spandrels will be included in the cost of the related items and will not be measured for payment. Payment for the landing area at access ramps will be included in the lump sum bid.

Payment for access ramps shall be made at the contract lump sum bid price. The landing area and PC Concrete is considered in the cost of the sidewalk. The ramp pay item shall include only the portion of the ramp within the distinctive scoring markings shown on the standard plans, and shall not include concrete surfaces

between curb returns as indicated on the standard drawings. The 3' x 4' truncated dome panel required (yellow "CastinTact" or equivalent set-in-concrete style) shall be included in the bid item for Truncated Domes.

The aggregate base required under curb and gutters, cross gutters, and spandrels, and driveway approaches shall be included in the cost for the related items of work and no additional compensation will be allowed.

SECTION 306 – UNDERGROUND CONDUIT CONSTRUCTION

306-1.1.1 General. [Add the following]:

PVC pipe shall be in conformance with Section 207-17, "PVC Plastic Pipe" and Subsection 306-1.2.13, "Installation of Plastic Pipe and Fittings", 306-1.3, "Backfill and Densification", and 306-1.2.12, "Field Inspection for Plastic Pipe and Fittings".

Fire Hydrant installation will be by the Coachella Valley Water District (CVWD.) Contractor shall coordinate and schedule with the District for hydrant relocation work.

306-1.6 Basis for Payment for Open Trench Installations. [Add the following]:

The Contract unit price paid per linear foot of PVC drain pipe and Schedule 80 Irrigation Sleeves shall include full compensation for all materials, labor, tools, equipment and incidentals, and for doing all the work involved in supplying and installing PVC pipe, complete in place including, but not limited to, excavation and disposal of materials, bedding materials, backfill, and compaction, finish surface replacement as shown on the Plans, per these Special Provisions, and as directed by the Engineer, and no additional compensation will be allowed therefore.

Full compensation for coordinating with the Coachella Valley Water District for Fire Hydrant relocation shall be considered as included in the Contract Lump Sum Price and no additional payment will be made thereof.

SECTION 308-4 – PLANTING

308-4.5 Tree and Shrub Planting [Add the following]:

Relocate Trees (aka "Transplant Trees")

Trees to be transplanted shall be removed and stored or transplanted to the locations shown on the plans in conformance with the provisions in Section 20-4, "Highway Planting," of the Standard Specifications and these special provisions.

When the trees are removed and the work within the areas to which the trees are to be transplanted is not completed to the stage at which the trees can be planted, the trees shall be stored and maintained until transplanting can be completed. In other cases, the trees shall be planted at the new locations the same day the trees are removed.

Trees to be transplanted shall be pruned just prior to removing the trees. Pruning of trees to be transplanted shall include removal of broken or bruised branches one inch or larger in diameter, deadwood, and suckers. Pruning shall be in conformance with the provisions in Section 20-4.055, "Pruning," of the Standard Specifications. Tree seal compounds shall not be used to cover pruning cuts.

Removed pruned materials shall be disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications. At the Contractor's option and expense, prunings may be reduced to chips. Chipped materials shall be spread within the highway right of way at those locations designated by the Engineer.

The Contractor shall determine the methods to be used to transplant trees, including removing, transporting, storing if required, planting, guying, and maintaining the trees. The Contractor shall submit a proposed plan for this work, in writing, to the Engineer prior to the start of the work. The proposed plan shall include, but not

necessarily be limited to, root ball size, method of root ball containment, and maintenance programs for each tree to be transplanted.

When trees are planted, a root stimulant, approved by the Engineer, shall be applied to the roots of each tree in conformance with the printed instructions of the root stimulant manufacturer. A copy of the instructions shall be furnished to the Engineer before applying any stimulant. Root stimulant to be used shall be submitted to the Engineer not less than 2 weeks prior to the stimulant's intended use. Root stimulants not approved by the Engineer shall not be used.

Holes resulting from the removal of transplanted trees shall be backfilled the same day the trees are removed. Soil from the surrounding area may be used to backfill these holes. The backfill shall be graded to conform with the adjacent existing grade. Watering basins shall be constructed around each transplanted tree.

Trees to be transplanted shall be maintained from the time the trees are removed to the time of acceptance of the contract, provided however, that the contract will not be accepted unless the trees have been satisfactorily maintained for 90 days after transplanting has been completed. The trees shall be watered and fertilized as necessary to maintain the trees in a healthy condition. Trash, debris and weeds within basins, including the basin walls, shall be removed and disposed of in conformance with the provisions in Section 7-1.13, "Disposal of Material Outside the Highway Right of Way," of the Standard Specifications. Weeds shall be removed before the weeds exceed 2 inches in length. Pesticides to be used for weed control shall be submitted to the Engineer not less than 2 weeks prior to their intended use. Pesticides not approved by the Engineer shall not be used.

The quantity of transplant trees will be measured by the unit as determined from actual count in place, excluding additional replacement trees.

The contract unit price paid for transplant tree shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in transplanting trees, complete in place, as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

314 Traffic Striping, Curb and Pavement Markings and Pavement Markers

314-1 General [Add the following]:

Traffic signs, stripes, legends, and raised pavement markers shall conform to California Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) 2012 Edition.

Markers and delineators shall conform to the provisions in Section 82, "Markers and Delineators," of the State Standard Specifications and these special provisions.

Flexible posts shall conform to the details shown on the plans and shall be, at the **CONTRACTOR'S** option, one of the following types, or equal:

Type	Manufacturer or Distribution
Auto Post	Western Highway Products P.O. Box 7 Stanton, CA 90680 Telephone (800) 422-4420
Carsonite Electron MCD Road marker CRM-375 Curve-Flex CFRM-400	Carsonite International Corp. 2900 Lockheed Way Carson City, NV 89701 Telephone (702) 883-5104
Safe-Hit Self-Locking Guide Post (SH248SLP)	Safe-Hit Corporation 1930 West Winton Avenue Building #11 Hayward, CA 94549 Telephone (415) 783-6550

Flexible posts shall be made from a flexible white plastic which shall be resistant to impact, ultraviolet light, ozone and hydrocarbons. Flexible posts shall resist stiffening with age and shall be free of burns, discoloration, contamination, and other objectionable marks or defects which affect appearance or serviceability.

The first coat of traffic striping shall be placed within 24 hours after the new roadway surface is complete. The second and final coat of traffic striping shall be placed no earlier than 14 calendar days after the first coat or at the time the reflective pavement markers are placed.

Traffic striping shall conform to Sections 210 and 310 as modified by these Special Provisions. Traffic control shall be as per APWA "WATCH" Handbook and the current California Department of Transportation California Manual on Traffic Control Devices, 2006 Edition.

Raised pavement markers shall conform to the California Department of Transportation, Standard Specifications, Section 85 and shall be of the type as called for on the Plans and these special provisions.

All lines 8" or greater in width shall be thermoplastic, unless otherwise noted.

All legends, crosswalks, limit lines, and shapes shall consist of Alkyd Resin Thermoplastic, unless otherwise noted (See Specifications below). Legends shall conform to City stencils, size and shape.

Any removal of conflicting traffic stripes and markings shall be accomplished by the wet sandblasting method or waterblasting method. The machine used for this purpose shall meet all requirements of the air pollution control district having jurisdiction in the project area. All sand used in wet sandblasting shall be removed by the use of a street sweeper without delay as the operation progresses.

Crosswalk lines, stop limit lines, and chevrons are considered as pavement markings.

All thermoplastic markings shall be reflectorized.

Placement of markers using bitumen adhesive shall conform to the requirements for placing markers in said Section 85-1.06 of the State Standard Specifications, except as follows:

Markers shall not be placed when the pavement or air temperature is 50° F or less.

The Contractor shall paint all new curb and gutter placed on the outside of the roadway red. Curb to be painted shall be marked for approval prior to painting.

Signs shall be set on steel 2" X 2" (brown) quick punch posts, with 2 ¼" X 2 ¼" sleeved base set in a PCC base of 560-C-2500 concrete. All posts shall be electrostatically powder coated with City approved brown coating. Base shall be a minimum of 24" deep by 12" square (City of Rancho Mirage Standard Detail No. 602, unless otherwise noted), as directed by the **ENGINEER**.

New signs shall be per sizes shown on plans. All warning, regulatory and guide signs shall be 3M (or pre-approved equal) high intensity grade reflective. Prior to installation, all new signs shall be approved by the City of Rancho Mirage.

Contractor shall paint 4" wide white centerline extensions through the intersections with dual left turns per Caltrans Standard Plan A20D, Detail 40.

314-4.3.4 Application Equipment

314-4.3.4.1 General [Add the following]:

All parts of the equipment which come in contact with the material shall be constructed for easy accessibility for cleaning and maintenance. The equipment shall operate so that all mixing and conveying parts, including the line dispensing device, maintain the material at the plastic temperature. The use of pans, aprons, or similar appliances which the dispenser overruns will not be permitted. The equipment shall provide for traffic marking application of varying widths.

The application equipment shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc.

Glass spheres shall be applied to the surface of the completed stripe by an automatic bead dispenser attached to the striping machine so that the beads are dispensed closely behind the installed line. The glass sphere dispenser shall be equipped with an automatic cut-off control synchronized with the cut-off for the thermoplastic material.

A special kettle shall be provided for uniformly melting and heating the thermoplastic material. Each kettle must be equipped with an automatic thermostatic control device for positive temperature control and to prevent overheating or scorching of the material. The heating kettle and application equipment shall meet the requirements of the National Fire Underwriters of the National Fire Protection Association of the State and local authorities.

314-4.2 Control of Alignment and Layout

314-4.2.1 General [Add the following]:

Layout - The **CONTRACTOR** shall furnish the necessary control points for all striping and markings, and shall be responsible for the completeness and accuracy thereof, to the satisfaction of the **ENGINEER**.

The **CONTRACTOR** shall perform all layout, alignment, and spotting for traffic stripes and markings. Traffic striping shall not vary by more than ½ inch in 50 feet from the alignment shown on the lanes. The dimensional details of the stripes and markings shall conform to the provisions set forth in the Traffic Manual and Maintenance Manual, available from **CALTRANS**.

Spotting with cat tracks or dribble lines shall be performed prior to the removal of existing stripes. Cat tracks shall consist of spots of paint not more than 3 inches in width and not more than 5 feet apart along the alignment of the stripe. Paint for the cat tracks shall be the same color as that for the intended stripe.

Spotting - Spotting shall be completed prior to the removal of any existing stripes or markings. Existing stripes and markings shall be removed prior to painting new ones, but in no case shall any section of street be left without the proper striping for more than 24 hours, or over weekends or holidays.

NO STRIPING SHALL BE INSTALLED UNTIL THE LAYOUT AND SPOTTING HAVE BEEN SPECIFICALLY APPROVED BY THE ENGINEER.

314-4.3.5 Application of Paint [Add the following]:

A primer sealer, recommended by the manufacturer of the thermoplastic material, shall be applied prior to the installation of the thermoplastic material on Portland Cement Concrete surfaces, and on other types of pavement if recommended by the thermoplastic material manufacturer. The primer shall be void of solvent and water prior to the installation of the thermoplastic material.

For optimum adhesion, the thermoplastic material shall be installed in a melted state at a temperature between 400-440F (204-226C) on a clean, dry, and solvent-free surface.

Longitudinal lines shall be offset at least 2 inches (5 cm) from the construction joint(s) of Portland Cement concrete pavements and joint(s) and shoulder breaks of bituminous concrete pavements.

Thermoplastic pavement marking materials shall not be applied by the extrusion method when pavement temperatures are below 50F (10C), or by the spray method when the pavement temperatures are below 55F (13C), or when the surface of the pavement shall evidence moisture. If thermoplastic material is not dispensed by a screen/extrusion device or a spray device, the material shall not be applied when the pavement or air temperature is below 65F (18C).

NOTE: Opening 6 inches (15 cm) in length may be provided at 20 foot (6 cm) intervals in edgelines placed on the inside of super elevated curves to prevent ponding of water on the pavement surface.

Thickness measurement shall be accomplished by placing black tapes, film, or metal plates of known and uniform thickness in the area to be striped. Once the striper has passed over, the sample is removed by making sharp cuts with a knife, and measurements of the stripe plus film are made with a micrometer or vernier calipers with a property correction for the film base. For longitudinal lines, these thickness checks shall be made every 1.3 mile or more frequently, at the judgment of the Engineer. For symbols and intersection markings, the frequency of checking shall be at the option of the Engineer. These thicknesses shall be considered as the average of 2 or more measurements made in a 3 foot distance.

314-4.7 Observation Period [Add the following Section]:

Prior to consideration of final acceptance of all work completed under these sections and as shown on the plans, there shall be a 90-day observation period, beginning upon the satisfactory completion of all work required by the intermediate completion date to be determined by the City Engineer for substantial completion of the work.

During the 90-day observation period, the thermoplastic pavement marking material furnished and installed shall be warranted against failure due to blistering, excessive cracking, bleeding, staining, discoloration, oil content of the pavement materials, smearing or spreading under heat, deterioration due to contact with grease deposits, oil diesel fuel, or gasoline drippings, chipping, spalling, poor adhesion to the pavement materials, loss of reflectivity, vehicular damage and wear.

The CONTRACTOR, at no expense to the City, shall replace any pavement markings that will not perform satisfactorily under traffic during the 90-day observation period due to defective materials and/or application. (Failure to comply with any portion of this specification shall be considered as unsatisfactory performance of the thermoplastic pavement marking material.

Marking replacement shall be performed in accordance with the requirements specified herein for the initial application, including but not limited to, surface cleaning, pavement marking removal, seasonal and weather limitations, etc.

314-4.8

314-4.9 Warranty [Add the following section]:

The thermoplastic pavement marking materials furnished and installed by the CONTRACTOR under this specification shall be guaranteed by the CONTRACTOR against failure due to poor adhesion resulting from defective materials or methods of application.

For non-defective pavement surfaces carrying volumes less than 50,000 vehicles per day, the CONTRACTOR shall guarantee to replace or renew, without cost to the City, that part of the pavement markings installed which have not remained to perform useful service as follows:

Stop a) Crosswalks, stop lines and legends – 75% of the total any one intersection for one year.

b) Lane lines, edgelines and centerlines – 90% of a unit for two years and 80% of a unit for four years. [A “unit” is defined as any length of highway having installed thereon 2,000 lineal feet (610 meters) of line of specified width in any combination or pattern.]

The replacement material installed under this guarantee shall be guaranteed the same as the original material, from the date of the original installation.

314-4.4.6 Payment [Add the following section]:

Payment for pavement markers shall be included in the **lump sum** bid, and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, including establishing alignment for layout work as shown on the plans and as required in the Specifications.

Payment for red curb painting shall be included in the **lump sum** bid, and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, including painting the new curb of the outside curb and gutter as shown on the plans and as required in the Specifications.

Payment for Traffic Stripes and Pavement Markings shall be considered as included in the **lump sum** bid, and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved in traffic stripes, and pavement markings, including establishing alignment for stripe and layout work as shown on the plans and as required in the Specifications.

314-5.7 Install, Remove and Relocate Roadside Signs [Add the following Section]:

Existing roadside signs at locations shown on the plans to be removed shall not be removed until replacement signs have been installed or until the existing signs are no longer required for direction of public traffic, unless otherwise directed by the **ENGINEER**.

New roadside signs shall be installed at the locations shown on the plans or as directed by the **ENGINEER**, and shall conform to the provision in Section 56-2 “Roadside Signs,” of the State Standard Specifications and these Special Provisions.

314-5.7.1 Payment [Add the following section]:

Payment for removing and relocating roadside signs shall be considered as included in the lump sum bid, and shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals as shown on the plans and as required in the Specifications.

Payment for new traffic roadside signs and posts shall be considered as included in the lump sum bid, and shall include full compensation for furnishing all labor, materials, tools and equipment for installing sign panels, and sign posts, footings and other related appurtenances as shown on the plans, and as required in the Specifications.

END OF SECTION

00 54 13 – SUPPLEMENTARY SCOPE STATEMENT

PART 1 WORK SPECIFIED HEREIN

1.1 This general understandings and responsibilities for the Project is complementary to the General Conditions and Supplementary General Conditions. Nothing herein shall be considered to waive any requirements of the General Conditions or Supplementary General Conditions.

- A. This section describes the project in general terms. Refer to other sections for specifics.
- B. Terms, directions, instructions, schedules, and performances are more specifically described in other sections of the specifications and drawings.
- C. Work of this Contract comprises general construction of a new 1 story multi-tenant retail shopping center.

1.2 DEFINITIONS

Definitions of various terms used on the Drawings or Technical Specifications are:

- A. "Remove" means to remove, permanently or temporarily, whichever is called for or implied, and making all disconnects reconnects and/or capping.
- B. "Install" means provide and install new and complete, and connect.
- C. "Provide" means install existing material or items, including all connection work.
- D. "Reinstall" means install existing material or items, including all connection work.
- E. "Re-hang" means install existing items.
- F. "Repair" means repair to original working order, complete and to match.
- G. "Replace" means provide and install replacement item, new and complete, to match original or as may be otherwise specified, including all disconnect and reconnect work.
- H. "Tenant" means the occupant of a designated space.
- I. "Salvage to Owner" means salvage all materials in usable condition.
- J. Owner's Representative: Throughout the specifications, the term "Owner's Representative" has been used instead of the term "Architect." In some cases the Owner's employee will provide services and responsibilities normally provided by the Architect. The Owner will clarify whether the Architect is acting as the Owner's Representative, or if the Owner's employee is acting as the Owner's Representative for the project.

PART 2 BUILDING AND SITE EXAMINATION

- 2.1 The Contractor shall visit the building site and examine the area where work is to be performed and all related equipment, materials and attachments to familiarize himself with the character of materials and labor to be encountered for the work, and any other conditions affecting the work under all sections of this Specification.
- A. It is essential that the work be accomplished as quickly as possible.
 - B. On regular workdays, work shall not start before 7:00 a.m. or be carried no later than 4:00 p.m. local time. In the event of unique circumstances, work hours may be extended and may include weekend days at the discretion of the Public Works Director. During holidays, no work shall be done on the day within which the holiday falls. These days shall be included in total Construction Time.

The following dates are to be considered partial construction days where construction shall conclude at Noon, and construction fencing shall be moved in order to open all available parking spaces:

November 15, 2016	January 30, 2017
December 13, 2016	February 3, 2017
January 17, 2017	February 6, 2017
January 19, 2017	February 7, 2017
January 20, 2017	February 14, 2017
January 26, 2017	March 30, 2017
January 27, 2017	

- C. Before starting the work schedule of buildings to be made available, starting and completion times and rates of completion shall be drafted by the Contractor In Conjunction, with the Owner and Architect.
- D. The schedule shall be structured so as to provide the Owner with at least 3 days' notice before starting work in any specific building. During the course of construction, any contemplated speed-up of the schedule shall be coordinated with the Owner to allow for proper notification to tenants by the Owner.
- E. The Contractor shall take field measurements as may be required for any and all work items included in the work.

1.2 CONTRACTOR'S DUTIES

- A. Except as specifically noted, provide and pay for:
 - 1. Labor, materials and equipment.**
 - 2. Tools, construction equipment and machinery.**
 - 3. Water, heat, and utilities required for construction.**
 - 4. Other facilities and services necessary of proper completion of work.**
- B. Secure and pay for, as necessary for proper execution and completion of Work, and as applicable at time of receipt of bids:
 - 1. Government Fees including inspection fees.**
 - 2. Licenses.**
- C. Give required notices.
- D. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on performance of Work.
- E. Promptly submit written notice to Owner's Representative of observed variance of Contract Documents from legal requirements. Assume responsibility for Work known to be contrary to such requirements, without notice.

1.3 CONTRACTOR USE OF PREMISES

- A. Limit use of premises for Work, for storage, and for access, to allow for:
 - 1. Work by other contractors.**
- B. Coordinate use of premises under direction of Owner.
- C. Assume full responsibility for protection and safekeeping of products under this Contract.
- D. Obtain and pay for use of additional storage or work areas needed when required for operations under this Contract.

1.4 NATIONAL ACCOUNT AGREEMENTS

- A. Note that Owner may enter into national account agreements with the certain vendors. Refer to Scope of Work Drawings.
- B. Purchase of equipment from these vendors is to be made by the respective sub-contractor, with confirmation of the purchase given to the Owner.
- C. Contractor remains responsible for delivery, storage, rough-in requirements, and installation of purchased equipment.

PART 3 SHOP DRAWINGS AND CATALOG CUTS

- 3.1 The Contractor shall check and verify all field measurements and shall submit with such promptness as to cause no delay in his own work or in that of any other Setting drawings and schedules required for the work of various trades. The Architect will review with reasonable promptness, such schedules, cuts and drawings only for conformance with the design concept of the project and compliance with the information given in the Contract Documents. The Contractor shall make all corrections required and resubmit to the Architect the corrected copies.
- 3.2 In viewing the schedules, cuts and drawings the Architect does not relieve the Contractor from responsibility for errors and omissions which may exist. Reviewing these submittals shall be considered as gratuitously assisting the Contractor and neither the Architect no the Owner assumes responsibility for errors or omissions in them. Where such errors or omissions are discovered later, they shall be made good by the Contractor, irrespective of the review of the submittals by the Architect.

PART 4 PROTECTION

- 4.1 Provide and maintain all fences, barricades lights, shoring and other protective structures or devices necessary for the safety of workmen, equipment and public and property as required by State or Municipal regulations, ordinances, laws and other requirements of the City, State and other authorities having jurisdiction with regard to safety, precautions, operations and fire hazards.
- 4.2 The work shall be done with the least amount of inconvenience to the users, the public, and adjacent property occupants. Precautions and protective measures shall be employed to avoid and/or control debris and rubbish from accumulating around the areas building where work is being done. These precautions and protective measures shall be submitted in writing for the Owner's approval at the pre-job conference
- 4.3 The Contractor shall make all repairs and replacements caused by damage and/or loss caused to construction operations at no additional cost to the Owner.

PART 5 MATERIALS AND WORKMANSHIP

- 5.1 All materials used under these specifications shall be new and unused, unless otherwise specified.
- 5.2 Materials and/or workmanship failing to meet these requirements shall be replaced at the Contractor's expense. Acceptance of materials and/or workmanship by an authorized representative of the Owner prior to completion of the Contract relieves the Contractor from his responsibility and obligation to turn over the same in first class condition at the completion of the work.
- 5.3 All work shall be performed by the mechanics skilled in their respective trades in accordance with the best practices of the trade and in accordance with all existing applicable codes.
- 5.4 Where the phrase "or equal" or "or equal as approved by the Architect" occurs in the Contract Documents, do not assume that any proposed equal material, equipment or method will be approved as equal by the Architect unless the item has been specifically approved and accepted for the work by the Architect under provisions for substitution requests covered in Information for Bidders.

PART 6 COMPLIANCE WITH CODES

- 6.1 In addition to any other warranties set out elsewhere in this Contract, the Contractor warrants that the work performed under this contract conforms to the contract requirements and is free of any defect of equipment, material or design furnished or workmanship performed by the Contractor or any of his Subcontractors or suppliers at any tier. Such warranty shall continue for a period of one year from the date of final acceptance

- City of Rancho Mirage City Project No. CP15-315 Rancho Mirage Observatory□
- to the work but with respect to any part of the work of which the Owner takes possession and use prior to final acceptance, such warranty shall continue for a period of one year from the date Owner takes possession and use. Under this warranty, the Contractor shall also restore any work damaged in fulfilling the terms of this clause. The contractor's warranty with respect to work done will run for one year from the date of acceptance by Owner.
- 6.2 Owner shall notify the Contractor in writing within a reasonable time after the discovery of any defect or damage.
- 6.3 Should the Contractor fail to remedy any failure, defect or damage described above within a reasonable time after receipt of notice thereof, Owner shall have the right to replace, repair or otherwise remedy such failure, defect or damage at the Contractor's expense.
- 6.4 In case of partial acceptance(s) due to nature of project, i.e. installation of water, could be finished before block wall etc. Each part of project shall have its own acceptance date and warranty period as described above.

END OF SECTION

01 10 00 – SUMMARY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Project Identification: (Rancho Mirage Observatory, Rancho Mirage, California)
- B. Project Summary: Construct new building, walks, and remodeled parking area.
- C. Particular Project Requirements:
 - 1. Existing site conditions and restrictions: (Build up to existing property line at wash and drainage route).
 - 2. Requirements for sequencing, scheduling and completion date:
 - 3. Prior or concurrent work by Owner or others:
 - 4. Pre-purchased and pre-ordered items: Telescope and other technical equipment. Verify with the city and determine installation schedule and responsibilities.
 - 5. Owner-purchased, Owner-installed items are to be verified with the city.
 - 6. Owner-purchased, Contractor-installed items supplied by the owner are to be verified.
 - 7. Occupancy of adjacent facilities: Library operations must continue during construction.
 - 8. Contractor's use of new and existing facilities: verify temporary power and water.
 - 9. Scope of separate prime contracts: verify specialty equipment installations arranged by the owner.
- D. Permits and Fees: Apply for, obtain, and pay for permits, fees, and utility company back charges required to perform the work. Submit copies to Architect.
- E. Codes: Comply with applicable codes and regulations of authorities having jurisdiction. Submit copies of inspection reports, notices and similar communications to Architect.
- F. Dimensions: Verify dimensions indicated on drawings with field dimensions before fabrication or ordering of materials. Do not scale drawings.
- G. Existing Conditions: Notify Architect of existing conditions differing from those indicated on the drawings. Do not remove or alter structural components without prior written approval.
- H. Coordination:
 - 1. Coordinate the work of all trades.
 - 2. Prepare coordination drawings for areas above ceilings where close tolerances are required between building elements and mechanical and electrical work.
 - 3. Verify location of utilities and existing conditions.
- I. Installation Requirements, General:
 - 1. Inspect substrates and report unsatisfactory conditions in writing.
 - 2. Do not proceed until unsatisfactory conditions have been corrected.
 - 3. Take field measurements prior to fabrication where practical. Form to required shapes and sizes with true edges, lines and angles. Provide inserts and templates as needed for work of other trades.
 - 4. Install materials in exact accordance with manufacturer's instructions and approved submittals.
 - 5. Install materials in proper relation with adjacent construction and with proper appearance.
 - 6. Restore units damaged during installation. Replace units which cannot be restored at no additional expense to the Owner.
 - 7. Refer to additional installation requirements and tolerances specified under individual specification sections.
- J. Limit of Use: Limit use of work as indicated. Keep driveways and entrances clear.
- K. Existing Construction: Maintain existing building in a watertight condition. Repair damage caused by construction operations. Protect building and its occupants.

L. Definitions:

1. Provide: Furnish and install, complete with all necessary accessories, ready for intended use. Pay for all related costs.
2. Approved: Acceptance of item submitted for approval. Not a limitation or release for compliance with the Contract Documents or regulatory requirements. Refer to limitations of 'Approved' in General and Supplementary Conditions.
3. Match Existing: Match existing as acceptable to the Owner.

M. Intent: Drawings and specifications are intended to provide the basis for proper completion of the work suitable for the intended use of the Owner. Anything not expressly set forth but which is reasonable implied or necessary for proper performance of the project shall be included.

N. Writing Style: Specifications are written in the imperative mode. Except where specifically intended otherwise, the subject of all imperative statements is the Contractor. For example, 'Provide tile' means 'Contractor shall provide tile.'

PART 2 PRODUCTS - Not applicable to this Section

PART 3 EXECUTION - Not applicable to this Section

END OF SECTION

00 31 13 - PROJECT COORDINATION**DIRECTORY**

OWNER: City of Rancho Mirage

PROJECT MANAGER: Randy Viegas, PMP, Project Manager
69825 Highway 111
Rancho Mirage, CA 92270
Phone: 760-770-3224
Email: randyv@RanchoMirageCA.gov

ARCHITECT: Narkweather Architects Inc.
c/o Charles Martin, Architect
Office: 760-346-4090
Email: Arcmartin@aol.com

Project Architect: Gerald Shingleton NCARB, Architect
Cell: 520-840-9613
Email: ShingArch@yahoo.com

Civil Engineer: Bob Mainiero, CE
Phone: 760-413-7127
Email: psbob596@aol.com

Landscape Architect: Ray Lopez
Phone: 760-831-6780
Email: rlascape@aol.com

CEC Title 24 Report: Scott Design and Title 24, Inc.
77085 Michigan Drive
Palm Desert, CA 92211
c/o Tim Scott
Phone: 760-200-4780
Email: timsconfig@title24foryou.com

Structural Design: Wynn Engineering, Inc.
27315 Valley Center Road
Valley Center, CA 92082
c/o Jack Starlin, SE
Office: 760-749-8722 Cell: 619-840-7990
Email: engrjack@cox.net

Structural Manager: Steve Reid, S.E.
Phone: 760-749-8722 / 310-306-9728
Email: steve@wynnengineering.com

Geotech Engineer: Landmark Engineering
Greg Chandra
Phone: 760-455-9345
Email: Gchandra@landmark-ca.com

Electrical-Engineer: MRC Engineering, Inc.
34300 Gateway Drive, Suite 120
Palm Desert, CA 92211
c/o Victor Leon, LEED AP. Principal
Office: 760-340-9005 ext 105 Direct: 760-983-2007 Cell: 760-578-5253
Email: vleon@mrc-e.com

00 31 24 – ENVIRONMENTAL ASSESSMENT**PART 1: GENERAL (Site Reports and Data)****1.1 RELATED DOCUMENTS**

- A. Related Documents: Provisions established in General and Supplementary Conditions of the Contract, Division 1 General Requirements, and the Drawings are collectively applicable to this Section.

1.2 INVESTIGATION

- A. An investigation of subsurface soil conditions at the building site was authorized by Owner, and these investigations were made by the soils engineer identified in the Directory.
- B. A property survey and topographic plat was authorized by Owner, and a scaled drawing was prepared by the civil engineer identified in the Directory and Drawings.
- C. Other property reports authorized by Owner may include, but not limited to, Greenhouse Gas and Air Quality, WQMP, CAL Green compliance, legal CC and R's, and title reports.
- D. An investigation results in a commissioned project. There are California regulatory provisions which must be met and are the property owner's responsibility.
- E. The building project is required to undergo an intensive quality assurance process.
1. Site lighting (controls)
 2. Site irrigation (controls)
- F. Commissioning ensures that the new site lighting, and irrigation controls operate as the owner intended and that building staff are prepared to operate and maintain its systems and equipment.

1.3 REPORT

- A. A copy of the exhibits (and other datum) are available if requested at the city.
- B. NOTE: Report and log of borings (available by contacting the geotechnical engineer) are for Contractor's information but is not a warranty of subsurface conditions, nor can it be completely relied upon as a part of the Contract Documents.
- C. Report and state of California compliance forms are for Contractor's information but is not a warranty of acceptable conditions.

1.4 RESPONSIBILITY

- A. Bidders are expected to examine the site, reports, and the subsurface investigation and then decide for themselves the character of the materials and conditions to be encountered.
- B. The Owner's Representative and Owner assume no responsibility for variations of subsoil quality or conditions of the site.
- C. Bidders are expected to examine the compliant investigation reports and then decide for themselves the compliant issues and Mitigation Measures stipulated in the Air Quality/Greenhouse Gas Assessment, WQMP, and other environmental related reports.
- D. The Owner's Representative and Owner assume no responsibility for manufacturing or installation errors resulting in state non-compliance issues

END OF DOCUMENT

01 32 19 – SUBMITTAL SCHEDULE**1.1 Work Specified Herein**

This Section outlines, in general, as a convenience to the General Contractor, submittals required before commencing construction or during the course of construction of the Project. This Section is complementary to the General Conditions and Supplementary General Conditions and nothing herein shall be considered to waive any requirements of the General Conditions or Supplementary General Conditions. Comply with all other provisions concerning submittal of Shop Drawings, Product Data and Samples.

1.2 General Requirements

- A. Submit number of copies of product data and manufacturer's instructions Contractor requires, plus 2 copies which will be retained by Owner's Representative and 1 copy for the Owner.
- B. Submit under Owner's Representative accepted form transmittal letter. Identify Project by title and number. Identify Work and product by Specification section and Article number.
- C. Provide complete submittals for each specified product, system or equipment. Partial or incomplete submittals will be returned, without review, for re-submission.
- D. Schedule submittals to expedite Project and in such sequence as to cause no delay in the Work or in the activities of Owner or of separate contractors. No extension of contract time will be authorized due to failure to transmit submittals in sufficient advance of the Work to permit processing.
- E. Deliver submittals to Owner's Representative's office. Submittals accepted only from Contractor.
- F. Apply Contractor's stamp, sign or initial and date certifying that review, verification of products, field dimensions, adjacent construction Work, and coordination of information, is in accordance with requirements of Work and Contract Documents.
- G. Submittals will be returned without processing if they have not been reviewed and stamped by Contractor for coordination of work and conformance with the Drawings and Specifications prior to submission to Owner's Representative, if they are not initialed or signed by authorized person, if they are not dated, or if it becomes evident that they have not been properly reviewed. Delays resulting therefrom are not responsibility of Owner's Representative.
- H. Clearly identify on submittals, or in writing at time of submission, deviations in submittals from requirements of Contract Documents.
- I. Do not perform Work on any element requiring submittal and review of shop drawings, product data, samples, or other similar submittals until respective submittal has been approved by Owner's Representative.
- J. Maintain in field office a copy of submittal schedule and log of submittals indicating current status of each item.

1.3 Construction Schedule and Cost Breakdown

- A. Within 10 working days of execution and delivery of the contract for construction and before the first partial payment is made, the General Contractor shall deliver to the Architect and Owner a Construction Progress Schedule in a bar chart form satisfactory to the Architect and Owner, showing the proposed dates of commencement and completion of each of the various subdivisions of the work required under the Construction Documents.
- B. Submit an itemized breakdown of the costs of the various subdivisions of the work on AIA Document G-702 and G-703 for the purpose of evaluating the work completed for each monthly payment. Each monthly Payment Request shall be submitted in the same form with all data required by the form completed.

- C. Submit all documents/data required by this Specification Manual within thirty (30) calendar days after signing contract for construction or issuance of a work order.

1.4 Progress Report

Submit monthly an updated Progress Report indicating work completed during the preceding month and indicate any revisions to the Construction Progress Schedule. Submit 3 copies with the Request for Payment.

1.5 Progress Charts

- A. Each month the General Contractor shall submit 3 copies of a graphic progress chart. Adjust the progress chart each month to graphically exhibit the status of each phase of the work, corrected to show any differentials in starting and completion dates included in the original chart
- B. Submit 3 copies with the request for payment.

2.1 Shop Drawing & Log

- A. Each month the General Contractor shall submit copies of the shop drawing log to Owner Construction Manager for review.
- B. The example contained within is to be used as a record shop drawing and sample log which is to be routed as directed and be kept current and available on site.
- C. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
1. Finishes which involve Owner's Representative selection of colors, textures, or patterns.
 2. Associated items which require correlation for efficient function or for installation.
- D. Present in a clear and thorough manner original drawings which illustrate the portion of the work showing fabrication, layout, setting, or erection details, prepared by a qualified detailer. Title each drawing with Project and Contract name and number; identify each element of drawings by reference to sheet number and detail, schedule, or room number of Contract Documents.
1. Check and coordinate shop drawings of any section or trade with requirements of other sections or trades and as necessary for proper coordination and complete installation of Work.
 2. Show layout, details, materials, dimensions, thicknesses, methods of assembly, attachments, relation to adjoining Work, wiring diagrams, rough-in requirements, and other pertinent data and information. Submit detail drawings of special accessory components not included in manufacturer's product data
 3. Identify field dimensions; show relation to adjacent or critical features of Work or products.
 4. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
 5. Revise and resubmit submittals as required, identify all changes made since previous submittal.
 6. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.
 7. Shop Drawing Sample Request for Information Logs.
 8. Attachment-3 is the Shop Drawing / Sample / and R.F.I.'s Logs to be maintained and routed.

2.2 Daily Reports

- A. The General Contractor shall maintain a written daily log at the job site, with copies provided to the Owner, submitted weekly. Report to include but not necessarily limited to the following:
1. Classification and number of workmen.
 2. Governmental Authorities at the site.
 3. Notification 48 hours prior to concrete pours.
 4. Description of work accomplished.
 5. Climatic conditions.
- B. Calculations:

1. When specified in individual Sections, submit calculations.
2. Submit engineering calculations for component sizes, deflections, and connections.
3. Submit calculations bearing seal and signature of registered professional engineer responsible for design.
4. Where existing conditions deviate from Contract Documents or shop drawings, submit calculations for existing condition, including calculations for anticipated corrective action required, and changes to loads transferred to "base building" structure.

C. Product Data

Submit only pages which are pertinent.

1. Mark each copy of standard printed data to identify pertinent products, models, options, and other data referenced to Specification Section and Article number.
2. Show reference standards, performance characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances.
3. Modify manufacturer's standard data, schematic drawings, and diagrams to supplement standard information and to provide information specifically applicable to the Work. Delete information not applicable.

After review, distribute copies of reviewed product data to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

D. Samples

1. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
2. Submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for Owner's Representative selection.
3. Where custom colors are specified, submit samples illustrating colors, textures, patterns, and finishes for Owner's Representative's review. Owner's Representative will advise colors required or furnish samples for color matching.
4. Submit samples to illustrate functional characteristics of products, including parts and attachments.
5. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of construction.

E. Informational Submittals

1. Informational submittals upon which Owner's Representative is not expected to take responsive action may be so identified in Contract Documents.
2. When professional certification of performance criteria of materials, systems, or equipment is required by Contract Documents, Owner's Representative shall be entitled to rely upon accuracy and completeness of such certifications.
3. Types of Informational Submittals:
 - a. Design data: Submit with shop drawings.
 - b. Test reports: Submit within 2 weeks of testing.
 - c. Certifications
 - d. Engineering Certifications:
 - e. Qualification Data
 - f. Manufacturer's Instructions:
 - g. Manufacturer's Certificates:
 - h. Manufacturer's Field Reports:

F. Contractor Review

1. Review submittal prior to transmittal; determine and verify field measurements, field construction criteria, quantities and details, manufacturer's catalog numbers, and conformance of submittal with requirements of Contract Documents.
2. Coordinate submittal with requirements of Work and of Contract Documents.
3. Sign or initial in a rubber-stamped review block format, each sheet of shop drawings and product data, and each sample label to certify compliance with requirements of Contract Documents. Notify

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- Owner's Representative in writing at time of submittal of any deviations from requirements of Contract Documents.
4. Do not fabricate products or begin work which requires submittal until return of submittal with Owner's Representative acceptance.
 5. Responsibility for errors and omissions in submittal is not relieved by Owner's Representative's review of submittal.
 6. Responsibility for deviations in submittal from requirements of Contract Documents is not relieved by Owner's Representative's review of submittal, unless Owner's Representative gives specific written acceptance of deviations. Owner's Representative will review submittal for general conformance to design intent only.

G. Owner's Representative and Engineer Review

1. Owner's Representative will review construction progress schedules, and submittal schedules. Owner's Representative will review product lists, shop drawings, product data, and samples and return within 15 working days of receipt.
2. Informational submittals and other similar data are for Owner's Representative's information and do not require Owner's Representative's responsive action.
3. Owner's Representative's review of submittals is for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents. Owner's Representative's review is not conducted for purpose of determining accuracy and completeness of items such as dimensions and quantities, which remain responsibility of Contractor.
4. Owner's Representative's review and approval of submittals does not relieve Contractor of responsibility for deviations from Contract Document requirements, unless Owner's Representative is informed in writing of deviations and approval is received in writing from Owner's Representative for such deviation.
5. Owner's Representative's review and acceptance of submittals does not indicate acceptance of changes in Contract time or cost.
6. Submittals stamped "No Exception Taken": No corrections or resubmittal required; fabrication may proceed.
7. Submittals stamped "Make Corrections Noted": Comply with noted corrections and modifications; and resubmit. Fabrication may proceed. If for any reason noted corrections and modifications cannot be fully complied with, resubmit for review requesting clarification; do not proceed with fabrication.
8. Submittals stamped "Rejected" or "Revised/Resubmit": Revise and resubmit for review; do not proceed with fabrication. Clearly indicate revisions, including corrections, to previous submittal. Disapproved submittals will not be considered valid cause for construction delay.
9. Submittal approval does not authorize changes to Contract requirements unless accompanied by a Change Order, Owner's Representative's Supplemental Instruction, or Construction Change Directive.
10. Owner's Representative will transmit 1 copy of Approved or Approved as Noted submittals to Owner.

END OF SECTION

01 32 20 – DEFERRED SUBMITTAL SCHEDULE

1.1 Work Specified Herein

- A. This Section outlines, in general, as a convenience to the General Contractor, construction permitting deferred submittals required before commencing construction or during the course of construction of the Project. This Section is complementary to the General Conditions and Supplementary General Conditions and nothing herein shall be considered to waive any requirements of the General Conditions or Supplementary General Conditions. See Section 01330 for provisions concerning submittal of Shop Drawings, Product Data and Samples.
- B. Refer to Section 01 32 19 for general submittal procedures.
- C. The city has purchased equipment and technical operational products which necessitate that specifically trained and certified installers are made available. The General Contractor must coordinate installers and consultants whom the city has hired (not a part of the building contract). Though the city is under contract with said consultants and specialty installers, the contractor must verify, schedule, and ascertain whether or not deferred submittals will be required and coordinate all installation schedules. Shop drawings and product data must also be submitted for the architect's review.

1.2 General Requirements

- A. **Submittal** - All deferred plans will be submitted no later than 90 days from the original plan approval.
- B. **Inspections Withheld** - A final inspection cannot be scheduled, Certificate of Occupancy (CO) will not be issued, and the final release of the utilities will not be granted until all deferred items have been reviewed, inspected and approved.
- C. **Holds on Permit** - The project will have "Restrictive Holds" entered in the CITY'S computer system to identify actions to be accomplished prior to final approval, or issuing a CO. Notes will be added to print on the building permit identifying the deferred submittal items.
- D. **Installation Prohibited** - It is the Owner, the Owner's Project Manager, and the General Contractor's responsibility to coordinate the submittal and approval of all deferred submittal items according to the compliance date. No deferred submittal item may be installed or erected prior to the structural plans being submitted and approved for the deferred items.
- E. **Engineer of Record Approval** - All deferred submittal items must be reviewed and approved by the engineer or architect of record prior to submitting the documents for plan review. The engineer must include in the structural plans the minimum required design / performance specifications. The manufacturer's title block or approval stamp on the shop drawing sheets must be marked (FOR CONSTRUCTION) and sealed on the structural plans, by the engineer of record.
- F. **Approved Fabricators** - All manufactured items require City Approval. The deferred items include, but not limited to, the following:
1. Prefab Wood Truss Details & Layout
 2. Wall and window-wall cladding
 3. Special door and window hardware
 4. Through-penetration fire-stop listing and details
 5. Fire sprinkler lines or heads, or fire alarm systems
 6. Safety systems that are not compatible with Contract Document Standards
 7. Sprinkler plans for hydraulic, brace and connection designs
 8. Seismic bracing of other types of mechanical or plumbing systems
 9. Major revision to original plans
 10. Alternate designs that change contract document

1.3 General Rules During Plan Review Stages

- A. The designers of record shall be prompted to determine all deferred submittal items and decide the scope of the designer's responsibility in the item's approval. Whether specifically referenced or not on working

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- drawings, shop drawings-cut sheets-product information-etc., submit (1) set of reproductions for the Architect's records plus (1) set to be checked by consultant and then reproduced by the contractor along with calculations (if applicable) for review and approval prior to fabrication. In no case will the Architect or his consultants be held responsible for shop drawing dimensional errors or quantities. Submit, among other deferred items, the following structural criteria:
1. Concrete Reinforcing bars
 2. Concrete Mix design
 3. Structural Steel
 4. Grout Mix design
 5. CMU Reinforcing
 6. Roof Trusses
 7. Curtain wall plans and calculations
- B. Anticipated deferred submittal items are clearly listed on the title or cover sheet of the approved plan sets and indicate the approximate event-certain for their submittal. All this has to be contained in the documents for approval prior to permit issuance. Schedule and allow (10) ten working days for shop drawings review commencing the next working day after receipt. **(Please plan construction schedule accordingly).**
- C. All non-structural and structural design criteria of the architect-of-record's, or AOR or the engineer-of-record's, or EOR, deferred submittals are stated in general notes and/or specifications.
- D. The logical effects on the entire building coming from proposed structural or fire-resistive protection-type of deferred submittal are considered in the original design; i.e. penetration of fire walls or floors, complete load path, point load from girder trusses, fire sprinkler water demand, etc.
- E. Before submitting material, the contractor shall;
1. Review each such submission for compliance and conformance with the means, methods, techniques, sequences and operations of construction, and safety precautions and programs incidental thereto, all of which are the sole responsibility of the contractor.
 2. Approve each submission by evidence of signature before submitting to architect/engineer.
 3. The contractor is fully responsible for any changes or delays caused by prematurely submitting review material prior to contractor review and approval.

1.4 After the Permit is Issued

- A. For purposes of this policy, the "applicant" is assumed to be the contractor, owner or the owner's authorized agent to include, but not be limited to, the architect of record or engineer of record, the project manager, the resident engineer or construction manager or any other owner authorized person.
- B. Ideally, submittal documents for deferred submittal items or **change orders** shall be submitted by the applicant to the architect or engineer of record who first shall review them and who, following the contract stipulations, forward them to the building official with a notation substantially indicating that the deferred submittal documents have been reviewed and that they have been found to be in general conformance with the design of the building. In some cases, documentation can come later in the process before approval is given on issuance of supplementary permit (major change orders). Nevertheless, no work can commence and/or fabrication can begin before the submittal is approved by the Building Department or Fire Department or both as the situation requires.
- C. At least three copies of deferred submittal items, plans, substitutions or change orders shall be submitted by the applicant to the building department for review and approval prior to installation. The city Building Department will provide administration of these deferred or changed items, sending on two of the three copies to the city Fire Department (when applicable) for their review. The applicant shall be responsible for coordination of the deferred submittal items and allow adequate review time by the building and fire departments to review these proposals (nominally 10 working days or sooner). It will be up to the applicant's consultants to resolve these issues and potentially issue new plan sheets.
- D. Building permit applications may be required for change orders and possibly for major modifications or substitutions. Fees will be required in accordance with the city's administrative rules. The applicant should contact the city Building Department to determine if one is required and what the fee may be before delivering the sets of plans and other contract documents.

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- E. Administratively, the city Building Department will identify the plans by Base-Permit number and Secondary-Submittal number and forward two of the copies to the Fire Department keeping one copy for review in the Building Department for review.
- F. Both Departments will review the plans within the agreed-upon time line and by an agreed- upon format including references to Code Sections in many cases to clarify what code provision it is that is requiring this potential revision. This allows for short to-the-point comments because the applicant can go to the relevant code and see the actual general or specific comment.
- G. Both Departments, subject to any mutually agreed-upon different procedure, shall issue their plan review letter comments together in one package for the convenience of the customer to the applicant and the AOR/EOR, as applicable, and/or other persons as requested by the Applicant. Courtesy copies will be forwarded to F & I Document Control and resident engineer. These later copies are considered informational only and won't require any action on their part, short of pointing out potential difficulties or conflicts with the construction documents.
- H. The written comment items are to be considered by the applicant and/or applicant's designers and the plans are to be revised as necessary to provide compliance with the legal fire and building code Provisions (and/or City Standards that are administered in a different Department's Submittal process.)
- I. The applicant and/or applicant's designers shall write a response to each of the comments about how it was solved and where on the plans or specifications this is resolved (for legal and practical reasons). Legally, since these comments are paraphrasing adopted codes and standards, the disposition of them needs to be officially documented. Practically, the cross-references helps the reviewer to efficiently complete the recheck without the need of a special meeting unless comments are very "minor". [The applicants should be aware that many comments can't be approved at a general meeting because they may include issues that crop up due to the change or alternatives both of which take time to discover or study. After the first recheck would generally be the time for a meeting, not before the recheck.]
- J. Three copies of revised documents, when necessary, are to be submitted back for final consideration and possible approval (four copies for sprinkler plan reviews). If the plans sets consist of 20 or less sheets, corrected individual sheets may be supplied in lieu of a full set of revised plans. Likewise, individual sheets may be supplied rather than a full set of Specifications, where necessary.
- K. It will be the commitment of the city to re-review and make plans for a meeting (a phone call would be the more likely and efficient alternative) to reconcile any remaining items within a five working day period subject to potential vacations, sicknesses or the like.
- L. City Departments will consider equivalencies or alternate standards assuming that they are submitted in accordance with the requirements in CBC Section 104.11) and/or CMC Section 105 (or CMC Section 105.2) and/or CPC Section 301.2 and/or CFC Section 103.1.2 (or IFC Section 104.9.) [Occasionally, this required proof will involve ICC Evaluation Service, Inc.'s Evaluation Reports and/or their successor reports, the ICC Evaluation Reports] After due consideration these proposals may or may not be deemed to be equivalent and the applicant will be notified of the outcome in writing and by phone.
- M. No one but those representatives from the city has the legal obligation or duty to reconcile these comments and approve alternatives. Resident engineers, construction managers, project managers and others may suggest solutions to the applicants but that in no way should be construed as making them a legally binding or acceptable alternative.
- N. When all comments have been approved (including written acknowledgement from the city as described above), the deferred/changed documents will be ready for approval. All applicable city agencies shall stamp the plans as APPROVED using their individual imprints. The three approved plans will be divided up such that one copy goes to each of the "Field" as an addition to the Approved Plans, and to the city departments for their files. Courtesy copies will be considered upon request.

01 33 20 – SPECIAL INSPECTIONS

PART 1: GENERAL

1.1 DESCRIPTION

INTRODUCTION: **Special inspection** is the monitoring of the materials and workmanship that are critical to the integrity of the building structure. It is the review of the work of the contractors and their employees to assure that the approved plans and specifications are being followed and that relevant codes and ordinances are being observed. The project owner or an agent of the owner is responsible for funding special inspection services. The special inspector/agency shall not be in the employ of the contractor, subcontractor or material supplier.

- Verify jurisdictional requirements with the city building official regarding the special inspector/agency employment.
 - Note: The special inspection process is in addition to those conducted by the municipal building inspector and by the registered design professional in responsible charge as part of periodic structural and contract document compliance observation.
 - Special inspectors furnish continuous or periodic inspection as prescribed in 2013 CBC. Good communication between the special inspector and the designers, contractor and building department is essential to project quality assurance.
- A. The design professional in responsible charge shall be a consenting party by written acknowledgment of special inspection and testing agreements. An example of such an agreement is included in Section 35 00 15. NOTE: The design professional in responsible charge has many duties and responsibilities related to special inspection.
- B. In addition to code required inspections identified in CBC Section 110, "Special Inspections" are applicable for certain structural aspects of the work.
1. **There are several areas of construction regulated by the CBC where special inspection is mandatory.**
 2. **These inspections are to verify that work that is considered critical to life safety and property protection is being or has been constructed according to the approved plans and specifications.**
 3. **Section 1704.1 of the CBC requires the owner (or the registered design professional acting as the owner's agent) to provide for specially qualified inspectors. However, the approval of these inspectors is solely the responsibility of the building official.**
 4. **Special inspections are in addition to the inspections specified in the 2013 CBC for specific structural observation which may also be required by other state mandated and locally adapted codes.**
- C. Special Inspections are not required for work of a minor nature as warranted by jurisdictional conditions determined by the building official. Also, where fabrication of structural load-bearing members and assemblies are being performed on the premises of the fabricator; note the exception for approved fabricators. See CBC Section 1704.2.
- D. Specific structural and land disturbing activities are to be performed by entities who are experienced and qualified in those operations and the special inspections may be:
1. **The Engineer of Record (sub-consultant who prepared the structural drawings) may, if approved by the jurisdictional authority, be permitted to act as the approved agency and their personnel are permitted to act as the special inspector for the structural work designed by them. In this case, the agency is hired separately by the owner and not employed by the architect of record.**
 2. **The Civil Engineer of record (agent of the owner who prepared the civil drawings) may, if approved by the jurisdictional authority, be permitted to act as the approved agency and their personnel are permitted to act as the special inspector for the civil and structural work designed by them.**

3. **The geotechnical soils engineer of record (agent of the owner who prepared the reports) may, if approved by the jurisdictional authority, be permitted to act as the approved agency and their personnel are permitted to act as the special inspector for the soil testing and fill compaction analysis.**
- E. Special inspector(s) must satisfy qualification requirements and be recognized as engaged in activities indicated.
1. **A special inspector is an individual with specialized skills who observes critical building or structural features identified by the design professional responsible for compliance to plans and specifications approved by the building official.**
 2. **Ensuring the competence of special inspectors is the responsibility of the building official. Although the CBC lacks specific qualification requirements, this fact does not lessen the importance of diligence in the critical process of verifying the governing jurisdiction authority in approving special inspectors.**
 3. **Note: the International Code Council® (ICC®) developed certification and accreditation programs to identify competent individuals and organizations that perform special inspection(s). Refer to Special Inspector Qualifications Guidelines (attachment 17 in project manual).**

1.2 GENERAL COORDINATION PROVISIONS

- A. NOTE: Testing and Inspection Services are the Owner's responsibility.
1. **The bidding contractor shall arrange for a qualified inspector, testing agency or agencies to perform all essentially necessary and required special structural inspection services, on behalf of the owner, and forward qualifications and proposals to same. The owner will be responsible for contracting direct with the agency performing the inspection work.**
 2. **Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.**
 3. **General contractor, as part of his duties and services must coordinate and schedule essential special inspections as required.**
 4. **Costs for retesting, construction deficiency corrections and re-inspections that replaces or is necessitated by work that failed to comply with Contract Documents will be back-charged to Contractor.**
 5. **Tests and inspections not explicitly assigned to Owner are the Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by governing authorities having jurisdiction, whether specified or not.**
- B. Special Inspections are defined as an engineering / consulting service and identified as a Sub-Consultant. The Sub-Consultant will be considered an independent third party hired by and in the interest of the project owner.
1. **Direct all Project communications to and through City's Project Manager.**
 2. **Assist as reasonably requested in City's Project Manager's project coordination.**
- C. The City's Project Manager is Randy Viegas.
- D. Special Inspection is for:
1. **Welding: Reinforcing Steel**
 - a. Periodic verification (other than ASTM A706)
 - b. Continuous inspection of moment frames and special structural assemblies
 - c. Continuous inspection of shear reinforcement
 - d. Periodic inspection of other re-bar welding
 2. **Steel: Sub-areas under steel construction includes, but not limited to:**
 - a. Material verification of high-strength bolts, nuts and washers
 - b. Inspection of high-strength bolting
 - c. Material verification of structural steel
 - d. Material verification of weld filler materials
 - e. Inspection of welding for both structural steel and reinforcing steel
 - f. Inspection of steel frame joint details for compliance with approved construction documents.
 - g. Periodic special inspection is required during steel frame construction for welding, screws, attachments, and anchoring of all wind-force-resisting systems, including shear walls, braces, diaphragms, collectors, drag struts and hold downs; except where the structural engineer determines that the system is classified as cold-formed light-frame steel with gypsum or fiberboard structural shear sheathing.
 - h. Note Exceptions 1 and 2 listed in Section 1704.3 discussing steel fabrication without heating operations of any kind and continuous and periodic inspection of certain welding operations.

- 3. Concrete: Sub-areas under concrete construction includes, but not limited to:**
- Periodic Inspection of anchors cast in concrete (strength design)
 - Periodic inspection of required mix design
 - Bolts to be installed in concrete prior to and during placement of concrete
 - Continuous verification of slump and air content tests / concrete temperature
 - Continuous inspection for maintenance of curing techniques
 - Periodic verification of formwork for shape, location, and dimensions
 - Isolated spread footings do not require special inspection
 - Continuous footings do not require special inspection
 - Sidewalks and slabs do not require special inspection
 - Note Exceptions 1, 2, 3, 4 and 5 in Section 1704 discussing footings for buildings three stories or less, nonstructural slabs, foundations and certain exterior concrete features when placed on grade. Be aware of criteria allowing use of these exceptions.
- 4. Masonry: Tables 1704.5.1 and 1704.5.3 show detailed information regarding Level 1 and Level 2 special inspections for masonry construction and whether continuous or period inspection is required.**
- Quality assurance program: TMS 402/ACI 530/ASCE 5 and TMS 602/ACI 530.1/ASCE
 - Verification of site-prepared mortar, construction of mortar joints and locations of reinforcement and connectors
 - Verification of size and location of structural elements, type, size and location of anchors including details of anchorage of masonry to structural members, frames or other construction
 - Verification of specified size, grade and type of reinforcement
 - Verifying welding of reinforcing bars
 - Verifying protection of masonry during cold or hot weather
 - Verifying prior to grouting to ensure grout space is clean and proportions of site-prepared grout
 - Verifying grout placement is in compliance with code and construction document provisions
 - Preparation of any grout specimens, mortar specimens and/or prisms
 - Verification of compliance with required inspection provisions of the construction documents and the approved submittals
 - Not required for masonry veneer
 - Not required for minor site built walls up to 6 feet high
- 5. Wood: inspection of the fabrication of wood structural elements and assemblies both prefabricated and field assembled or site built. See Section 1704.6.**
- Manufactured fabrication from a certified premises is exempt from field inspection.
 - CBC 1705.5.3 requires continuous fabrication inspection, written report, and individually inspected truss approval stamp.
 - The fabricator shall be responsible to hire the independent authority to provide this task approved by the local enforcement agency.
 - High-load diaphragms requires verification of grade and thickness and all connecting hardware.
 - Verification of structural wood panel sheathing for grade and thickness
 - Verification of nominal size of framing members.
 - Verification of diameter and length of fasteners and spacing of fasteners in the line of structural members and at panel edges. Verification of Trusses spanning 60 feet or more requires on-site verification of temporary restraints and bracing as well as permanent bracing and connection hardware specified on truss shop drawings and structural drawings.
- 6. Soils: Inspection of site for existing conditions, verification of site preparation prior to placement of prepared fill, verification of fill material and maximum lift thickness and verification that in-place densities meet the requirements of the approved soils report. See CBC Section 1704.7.**
- 7. Wind: City required design loads are 110 mph, exposure C which triggers the state requirements utilizing a special inspection for:**
- Structural wood construction, including nailing, bolting, anchoring, and fastening of the main wind-force resisting system which includes wood shear walls, wood diaphragms, drag struts, braces and hold downs.
 - Wall panels and veneers – Inspection of exterior and interior architectural wall panels and the anchoring of veneers for buildings assigned to Seismic Design Categories E and F. Inspections of veneers shall meet requirements of Section 1704.5. See Section 1704.10.
 - Exterior insulation and finish systems (EIFS) – See Section 1704.12 for exceptions to inspection when EIFS is applied over water-resistive barriers with a means for draining excess water and EIFS installed on masonry or concrete.
 - Mechanical and Electrical Components will require special inspection for the Anchorage of all equipment (due to seismic category).
- 8. Physical and visual testing includes observations to demonstrate compliance with the listing and the fire-resistance rating of rated substrates, including thickness compliance.**

- E. Procedures:
1. **Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.**
 2. **The Contractor may not employ the same entity engaged by the Owner, unless agreed to in writing by the Owner.**
 3. **Notify inspector and/or testing agency at least 24 hours in advance of time when Work that requires testing, observation, or verification will be performed.**
 4. **Where quality-control services are indicated as Contractor's responsibility in other parts of the project manual, specifications, or drawings, submit a certified written report, in duplicate, of each quality-control service.**
 5. **Testing and inspecting requested by Contractor and not required by Contract Documents are the Contractor's responsibility.**
 6. **Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.**
 7. **Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.**
- F. Testing Agency / Special Inspector responsibility:
1. **Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.**
 2. **Determine the location from which test samples will be taken and in which in-situ tests are conducted.**
 3. **Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.**
 4. **Submit a certified written report, of each test, inspection, and similar quality-control service to Contractor and Architect.**
 5. **When required by city, submit completed special-inspection form provided by the jurisdictional authority or, when none exist or available, use the form provided in the project manual (Section .**
 6. **Upon request of the Engineer, submit a final report of tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.**
 7. **Re-test and re-inspect corrected work.**
 8. **Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.**
 9. **Do not perform any duties of Contractor.**
- G. Test Reports: Prepare and submit certified written reports that include the following:
1. **Date of issue.**
 2. **Project title and number.**
 3. **Name, address, and telephone number of testing agency.**
 4. **Dates and locations of samples and tests or inspections.**
 5. **Names of individuals making tests and inspections.**
 6. **Description of the Work and test and inspection method.**
 7. **Identification of product and Specification Section.**
 8. **Complete test or inspection data.**
 9. **Test and inspection results and an interpretation of test results.**
 10. **Record of temperature and weather conditions at time of sample taking and testing and inspecting.**
 11. **Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.**
 12. **Name and signature of laboratory inspector.**
 13. **Recommendations on re-testing and re-inspecting.**
- H. Contractor Associated Services and Responsibilities: Cooperate with agencies performing tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. **Access to the Work**
 2. **Incidental labor and facilities necessary to facilitate tests and inspections.**
 3. **Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.**
 4. **Facilities for storage and field curing of test samples.**

5. **Delivery of samples to testing agencies when required.**
6. **Preliminary design mix proposed for use for material mixes that require control of testing agency.**
7. **Security and protection for samples and for testing and inspecting equipment at Project Site.**
8. **Schedule times for tests, inspections, obtaining samples, and similar activities.**

I. Repair and Protection:

1. **On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes. Provide materials and comply with installation requirements specified in other sections of the specifications and project manual items and information.**
2. **Protect construction exposed by or for quality-control service activities.**
3. **Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.**

PART 2: SCOPE

1.1 INSPECTION CRITERIA

Agent (Sub-Consultant) shall provide services in accordance with ICC standards and guidelines and pursuant to its standard protocols and procedures.

2.1 ADDITIONAL SERVICES:

- A. Services necessitated by substantial changes in the Project's program:
1. **Schedule or scope; by limitations on the timing of site availability**
 2. **By the failure to provide those services required of others as set forth in Section III**
 3. **By amendments to or changes in the interpretation of laws and other requirements applicable to the Project**
 4. **By conditions of which Engineer has not been timely informed**
 5. **By inadequate or improper co-consultant or contractor performance, unreasonable contractor requests or claims, multiple test failures and/or construction accidents**
 6. **Or by other matters beyond Engineer's reasonable anticipation and control.**
- B. Provide more than two (2) site visits for any one installation observation, pre-function check or functionality test.
- C. Provide reports or other instruments of service pursuant to other than Engineer's standard protocols and procedures, or in other than Engineer's standard formats and level of detail.
- D. The fee is based on performing site tasks during normal business hours Monday to Friday. Overtime rates will apply to work performed outside normal business hours.
- E. The fee is based on performing Functional Testing as part of a single-phase construction schedule prior to occupancy. If the commissioning process is extended due to scheduling delays, phased construction or occupancy the additional costs will be charged at agreed hourly rates.
- F. The fee is based on the same contracting team (General, mechanical, electrical, plumbing and landscape irrigation) working on both buildings and the site. If multiple contracting teams are used, additional costs will be charged at agreed hourly rates.
- G. Such other services as the parties may mutually agree.

2.2 SERVICE CLARIFICATIONS:

- A. In no event will the special inspection services or professional responsibilities include:
1. Soils engineering or other geotechnical services, or any responsibility for the Project's soils, subterranean water and/or subsurface conditions.
 2. Hazardous waste or toxic substances engineering or any responsibility concerning compliance with any federal or state environmental or pollution laws or for hazardous materials or toxic substances at the Project site, nor will Architect investigate any product for environmental or pollution hazards not identified in the published product literature of the product's manufacturer.

3. Serving as, supervise or have any responsibility for any contractor, and in particular will not have control or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures; for safety precautions and programs in connection with the Project; for the timeliness or quality of contractor performance or for the acts or omissions of any contractors or any other person performing any of the work of the Project, or for the failure of any of them to perform the work.

END OF SECTION

01 41 13 – CODES**PART 2: WORK SPECIFIED HEREIN**

This Section describes codes and regulations for the Project and is complementary to the General Conditions and Supplementary General Conditions. Nothing herein shall be considered to waive any requirements of the General Conditions or Supplementary General Conditions. Reference to standard specifications and codes refer to editions in effect at the time of proposal and include current addenda if any. Any questions arising during construction as to procedure, practice or requirement in any phase of work shall be decided by the applicable code.

PART 3: ADOPTED CODES & REGULATIONS

3.1 The General Contractor, together with representatives of his major subcontractors, shall familiarize themselves with relevant codes and regulations.

3.2 Governing Codes, Ordinances, and Regulations

- A. 2013 California Building Code, Volumes 1 & 2
 - 1. **Including Appendix Chapter C (2012 International Building Code)**
 - 2. **Including Appendix Chapter F (2012 International Building Code)**
 - 3. **Including Appendix Chapter I (2012 International Building Code)**
 - 4. **Including Appendix Chapter J (2012 International Building Code)**
- B. 2013 California Electrical Code (based on the 2011 National Electrical Code)
- C. 2013 California Mechanical Code (based on the 2012 Uniform Mechanical Code)
- D. 2013 California Plumbing Code (based on the 2012 Uniform Plumbing Code)
- E. 2013 California Energy Code (Title 24, Part 6)
- F. 2013 CAL Green Code (California Green Buildings Standards – effective January 1, 2014)
- G. 2013 California referenced Standards Code
- H. 2010 ADA Standards for Accessible Design
- I. 2010 California Fire Code (with city adopted amendments)
- J. California Code of Regulations, Title 17 (<http://ccr.oal.ca.gov/>)
- K. Public Resources Code (Ch. 18 of California Solid Waste Refuse and Recycling Access Act)
- L. ANSI (American National Standards Institute)
 - 1. **A10 Construction and Demolition Standards**
 - 2. **A14.2 / ANSI ASC A14.2 / A10.8 Ladder & Scaffolding**
 - 3. **Z4.3-1995 (R2005) Sanitation – Disposal Systems (minimum requirements)**
 - 4. **EIMA 99-A-2001 Exterior Insulation and Finish Systems (EIFS)**
 - 5. **Z-124.1 Accessibility Standards**
- M. San Bernardino County Storm-water Program (WQMP)
- N. Holt Boulevard Specific Plan (June, 1991) Development Standards
- O. City of Montclair Zoning Ordinance (and Development Standards)

3.3 "Certificate of Occupancy," is

- A. Amended and conditional by authority by adding the following minimum requirements which must be completed prior to any occupancy or utility connection:
 - 1. Written clearance from the Fire and Public Works Departments and Planning and Business License Divisions.
 - 2. Written clearance from the Water District, NPDES Coordinator, and Environmental Manager, when applicable.
 - 3. The following is required, (verify) when applicable:
 - a) Electronic imaging of plans received.
 - b) Verification of school fees paid.
 - c) Grading certificate received.
 - d) All plan review fees paid.
 - e) Sewer assessment fees paid.
 - f) Hazardous materials statements received.
 - g) Subcontractor's list received.
 - h) Parkland development fees received.
 - i) Transportation development impact fees received.

01 42 13 – ABBREVIATIONS & ACRONYMS**ABBREVIATIONS:**

#	Pound OR Number
&	And
@	At
ACT	Acoustic Ceiling Tile
AD	Area Drain
AFF	Above Finished Floor
ALUM	Aluminum
ANOD	Anodized
BSMT	Basement
BYND	Beyond
BOT	Bottom
CIP	Cast In Place
CHNL	Channel
CJ	Control Joint
CLG	Ceiling
CLR	Clear
CMU	Concrete Masonry Unit
COL	Column
COMPR	Compressible
CONC	Concrete
CONT	Continuous
CPT	Carpet
CT	Ceramic Tile
CTYD	Courtyard
DBL	Double
DEMO	Demolish or Demolition
DIA	Diameter
DIM	Dimension
DIMS	Dimensions

DN	Down
DR	Door
DWG	Drawing
EA	Each
EJ	Expansion Joint
EL	Elevation
ELEC	Electrical
ELEV	Elevator or Elevation
EPDM	Ethylene Propylene Diene M-Class (Roofing)
EQ	Equal
EXIST	Existing
EXP JT	Expansion Joint
EXT	Exterior
FD	Floor Drain or Fire Department
FEC	Fire Extinguisher Cabinet
FIXT	Fixture
FLR	Floor
FM	Filled Metal
FO	Face Of
FND	Foundation
GA	Gauge
GALV	Galvanized
GWB	Gypsum Wall Board
HC	Hollow Core
HI	High
HM	Hollow Metal
HP	High Point
HR	Hour
HVAC	Heating, Ventilating, And Air Conditioning
IRGWB	Impact Resistant Gypsum Wall Board
ILO	In Lieu Of
INSUL	Insulated or Insulation
INT	Interior
LO	Low

MAX	Maximum
MO	Masonry Opening
MECH	Mechanical
MEMBR	Membrane
MIN	Minimum
MRGWB	Moisture-Resistant Gypsum Wall Board
MTL	Metal
NIC	Not In Contract
NO	Number
NOM	Nominal
OC	On Center
OH	Opposite Hand
OZ	Ounce
PCC	Pre-Cast Concrete
PLUMB	Plumbing
PLYD	Plywood
PT	Pressure Treated
PNT	Paint or Painted
PVC	Polyvinyl Chloride
RBR	Rubber
RCP	Reflected Ceiling Plan
RD	Roof Drain
REQD	Required
RM	Room
SIM	Similar
SPEC	Specified OR Specification
SPK	Sprinkler or Speaker
SSTL	Stainless Steel
STC	Sound Transmission Coefficient
STL	Steel
STRUCT	Structure or Structural
T&G	Tongue And Groove
TELE	Telephone
TLT	Toilet

TO	Top Of
TOC	Top Of Concrete
TOS	Top Of Steel
TPD	Toilet Paper Dispenser
T/D	Telephone/Data
TYP	Typical
UNO	Unless Noted Otherwise
U/S	Underside
VIF	Verify In Field
VP	Vision Panel
W/	With
WD	Wood

01 42 16 – DEFINITIONS

PART 1:GENERAL

1.1 REFERENCE STANDARDS

- A. Comply with association, trade, federal, commercial, standards generating organization (such as ANSI and ASTM), and other similar standards referenced within Specification sections, except where more explicit or stringent requirements are indicated or required by Specification or applicable codes.
- B. Reference standards include their associated amendments and supplements.
- C. Except where a specific date is indicated, date of standard is latest edition in effect at date of Contract Documents, or date of standard required by code.
- D. Reference standards have same force and effect as if bound into or copied directly into Contract Documents; standards are made a part of Contract Documents by reference.
- E. Contractual relationship of parties to the Contract shall not be altered from Contract Documents by mention or inference otherwise in reference standards.
- F. Should specified reference standards conflict with Contract Documents, request clarification from Owner's Representative before proceeding.

1.2 EXPLANATION OF PROJECT MANUAL CONTENT

- A. Specifying Methods: Techniques or methods of specifying varies throughout text and may include "prescriptive," "generic-descriptive," "compliance with standards," "performance," "proprietary," or a combination of these.
- B. Language:
 - 1. **Imperative mood of sentence structure is generally used which places verb as first word in sentence. Except as otherwise indicated, requirements expressed imperatively are to be performed by Contractor.**
 - 2. **In certain circumstances, the language of specifications and other contract documents are of abbreviated type. It implies words and meanings that will be appropriately interpreted. Words such as "the," "shall," "shall be," "Contractor shall," "a," "all," "an," "any," and other similar words are eliminated.**
 - 3. **Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicates.**
 - 4. **The words "shall be" are implied wherever a colon (:) is used within a sentence or phrase.**
- C. Minimum Quality and Quantity: In every instance, quality level or quantity shown or specified is intended to be minimal for Work to be performed or provided. Except as otherwise specifically indicated, actual Work may either comply exactly with that minimum within specified tolerances, or may exceed that minimum within reasonable limits. In complying with these requirements, indicated numeric values are either minimums or maximums as noted, or as appropriate for context of requirements. Refer instances of uncertainty to Owner's Representative for decision before proceeding.

1.3 DEFINITIONS

- A. Custom Color: Refers to color selection by Owner's Representative that is not limited to a manufacturer's standard color or a manufacturer's color that is designated by the manufacturer as "custom", "premium" or any other designation. Custom color means any color selected by Owner's Representative.
- B. Directed, Requested: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" mean "directed by Architect," "requested by Architect," and similar phrases. However, no such implied meaning shall be interpreted to extend Owner's Representative's responsibility into area of construction supervision.
- C. Finish: The manner or method of completion. The final appearance of a surface, including texture, smoothness, sheen, and color, after finishing operations have been performed. Finishing operations include preparation of substrate and application, curing, and protection of specified finish materials.
- D. Furnish: Means to supply, purchase, procure and deliver complete with related accessories, ready for assembly, application, installation, and similar operations, as applicable in each instance.
- E. Indicated: Refers to graphic representations, notes, or schedules on Drawings, or other paragraphs or Schedules in Specifications, and similar requirements in Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help reader locate the reference. Location is not limited.

- F. **Install:** Means to construct, assemble, erect, mount, anchor, place, connect, apply and similar operations, complete with related accessories, as applicable in each instance, connected, operable, and ready for service or intended use.
- G. **Installer:** Entity (person or firm) engaged to perform a particular unit of Work at Project site, including installation, erection, application, repair, patching, and similar required operations. Such entities must be experienced in operations they are engaged to perform.
- H. **Or:** Used to introduce any of the possibilities in a series. Items in the series are not required to be taken jointly. It does not mean that individual items in the series are optional requirements.
- I. **Product:** Includes natural and manufactured materials, components, machinery, fixtures, equipment, devices, furnishings, systems, and their associated accessories to be incorporated into the Work.
- J. **Provide:** Means to furnish and install, complete and ready for operations and use for purpose intended.
- K. **Regulations:** Includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within construction industry that control performance of the Work.
- L. **Similar:** Interpreted in its general sense and not as meaning identical. Elements defined as "similar" shall be coordinated in relationship to their location and connection with other parts of the Work.
- M. **True To Line, Plumb, Level, and Flat:** Install Work within following tolerances, except where indicated otherwise:
 - 1. **True to line:** Allowed deviation from straight line within plus or minus 1/16 inch in 1 foot; plus or minus 1/8 inch in 10 feet; plus or minus 1/4 inch in 20 feet; and plus or minus 3/8 inch in lengths over 20 feet.
 - 2. **Level:** Allowed deviation from horizontal plane within plus or minus 1/16 inch in one foot; plus or minus 1/8 inch in 10 feet; plus or minus 1/4 inch in 20 feet; and plus or minus 1/2 inch in lengths over 20 feet.
 - 3. **Plumb:** Allowed deviation from vertical plane within plus or minus 1/16 inch in one foot; plus or minus 1/8 inch in 10 feet; plus or minus 1/4 inch in 20 feet; and plus or minus 1/2 inch in lengths over 20 feet.
 - 4. **Flat:** Allowed deviation from flat plane in any planar direction within plus or minus 1/16 inch in 1 foot; plus or minus 1/8 inch in 10 feet; plus or minus 1/4 inch in 20 feet; and plus or minus 3/8 inch in lengths over 20 feet.
 - 5. Tolerances are not accumulative.

END OF SECTION

01 45 16.13 – CONTRACTOR QUALITY CONTROL

PART 1:GENERAL

1.1 DESCRIPTION

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, workmanship, and site conditions, to produce Work in accordance with Contract Documents.

1.2 DEFINITIONS

- A. Field Samples: Partial installation of selected materials installed at Project site for Owner's Representative's review and approval of visual features and workmanship.
- B. Mock-ups: Full size assemblies that incorporate several materials or elements of construction erected for Owner's and Owner's Representative's review and approval of visual features and workmanship. Mock-ups represent quality of materials and workmanship required for Work.

1.3 PERFORMANCE REQUIREMENTS

A. Workmanship:

1. **Comply with industry standards of the region except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.**
2. **Provide suitably qualified personnel to produce Work of specified quality.**
3. **Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.**
4. **Provide finishes to match approved samples.**

B. Manufacturer's Instructions:

1. **Require compliance with instructions in full detail, including each step in sequence. Do not omit preparatory steps or installation procedures unless specifically modified or exempted by Contract Documents.**
2. **Maintain one complete set of instructions at Project Site during installation and until completion.**
3. **Should instruction conflict with Contract Documents, request clarification from Owner's Representative/Engineer before proceeding.**

C. Manufacturer's Certificates:

1. **When required in individual Specifications section, submit manufacturer's certificate, in duplicate, certifying that products meet or exceed specified requirements, executed by responsible officer.**

D. Manufacturer's Field Services and Reports:

1. **Submit reports in accordance with Section 01330.**
2. **Submit qualifications of field observer 30 days in advance of required observations; observer is subject to approval of Owner's Representative.**
3. **When specified in individual Specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces, quality of workmanship, and conditions of installation as applicable, and to initiate instructions when necessary.**
4. **Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions.**
5. **Submit reports within 7 days of observation. Distribute copies to Owner's Representative, Owner, Project site file, subcontractor, and other entities requiring information.**
6. **Provide one additional copy of reports for record documents file.**

1.4 QUALITY ASSURANCE

- A. Supervise performance of Work in such manner and by such means to ensure that Work, whether completed or in progress, will not be subjected to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.
- B. Ensure that persons performing Work are qualified to produce workmanship of specified quality.
- C. Monitor quality control over products, suppliers, manufacturers, services, site conditions, and workmanship to ensure Work complies with Contract Documents.

- D. Comply with specified reference standards as minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

1.5 EXAMINATION OF CONDITIONS

- A. Examine substrates and conditions under which Work is to be performed. Do not commence work over unsatisfactory conditions detrimental to proper and timely execution of Work.
- B. Do not proceed with Work until unsatisfactory conditions have been corrected.
- C. Commencement of installation constitutes acceptance of conditions and cost of any corrective measures are responsibility of Contractor.

1.6 MOCKUPS

- A. General:
 - 1. **Use materials, fabrication and installation methods identical with those indicated for Work. Simulate actual construction conditions as accurately as possible.**
 - 2. **Provide mock-ups required by individual Specification sections.**
 - 3. **Approval:**
 - a. Obtain Owner's Representative's written approval for each mock-up.
 - b. Do not start production of materials for final Project site erection until Project Manager's approval of mock-ups has been obtained.
 - c. Approved mock-ups will serve as standard of quality and workmanship of Work; maintain mock-ups until completion of relevant Work.
 - 4. **Upon completion of relevant Work or when directed by Project Manager, demolish and remove mock-ups.**

1.7 FIELD SAMPLES

- A. General:
 - 1. **Provide field samples at site required by individual Specification sections.**
 - 2. **Erect at location acceptable to Owner's Representative; perform Work in accordance with applicable Specification sections.**
 - 3. **Construct complete, including Work of related trades required in finished Work.**
 - 4. **Make adjustments necessary to obtain approval from Owner's Representative. Do not proceed with further work until sample installation has been approved by Owner's Representative.**
 - 5. **Approved samples will serve as standard of quality and workmanship of Work; maintain samples until completion of relevant Work.**
 - 6. **Upon completion of Work or when directed by Owner's Representative, demolish field samples and remove from site, unless accepted by Owner's Representative as part of completed Work.**

1.8 TESTING LABORATORY SERVICES

- A. General:
 - 1. **Where terms "Laboratory", "Inspector", "Inspection Laboratory", "Laboratory" or "Testing Laboratory" are used, they mean and refer to officially designated and accredited testing laboratory.**
 - 2. **Provide testing laboratory with one set of Contract Documents and relevant approved submittals.**
- B. Selection and Payment:
 - 1. **Owner will employ services of an independent testing laboratory to perform specified inspection and testing.**
 - 2. **Employment of testing laboratory in no way relieves obligation to perform Work in accordance with requirements of Contract Documents. Contractor will pay testing required by local authorities having jurisdiction.**
 - 3. **Where the Owner has engaged a testing agency or other entity for testing and inspection of a part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless otherwise agreed in writing with the Owner.**
- C. Laboratory:
 - 1. **Cooperate with Owner's Representative, Owner, and Contractor.**
 - 2. **Comply with requirements of ANSI/ASTM E 329 and ANSI/ASTM D 3740.**
 - 3. **Maintain a full-time registered Engineer on staff to review services.**

4. **Authorized to operate in State where the project is located.**
5. **Calibrate testing equipment once each year with devices of an accuracy traceable to either NBS Standards or accepted values of natural physical constants.**
6. **Test samples of mixes submitted by Contractor.**
7. **Provide qualified personnel at site. Cooperate with Contractor and Owner's Representative in performance of services.**
8. **Perform specified inspection, sampling, and testing of products in accordance with specified standards.**
9. **Ascertain compliance of materials and mixes with requirements of Contract Documents.**
10. **Promptly notify Owner's Representative, Owner, and Contractor of observed irregularities or non-conformance of Work or products.**
11. **Perform additional inspections and tests required by Owner's Representative.**
12. **Attend Preconstruction Conference.**

D. Laboratory Reports:

1. **After each inspection and test, promptly submit 2 copies of laboratory report to Owner's Representative and one to the applicable consultant and one to Contractor.**
2. **Include: Date issued, project title and number, name of inspector, date and time of sampling or inspection, identification of product and Specifications section, location in the Project, type of inspection or test, date of test, results of tests, and conformance with Contract Documents.**
3. **When requested by Owner's Representative, provide interpretation of test results.**

E. Limits on Testing Laboratory Authority:

1. **May not release, revoke, relax, alter, or enlarge on requirements of Contract Documents.**
2. **May not approve or accept any portion of the Work.**
3. **May not assume any duties of Contractor.**
4. **Has no authority to stop Work.**

1.9 CONTRACTOR RESPONSIBILITIES

- A. Deliver to laboratory at designated location adequate samples of materials proposed to be used which require testing, together with proposed mix designs.
- B. Cooperate with laboratory personnel, and provide access to Work and to manufacturer's facilities.
- C. Provide incidental labor and facilities to provide access to work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, and for storage and curing of test samples.
- D. Notify laboratory of material sources and furnish necessary quantities of representative samples of materials proposed for use which are required to be tested.
- E. Notify Owner's Representative and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.
- F. Advise laboratory in a timely fashion to complete required inspection and testing prior to subsequent work being performed.
- G. Pay for subsequent re-testing of products or systems found to be defective or otherwise not in accordance with specification requirements. Remove rejected products and replace with products of specified quality.
- H. Furnish copies of product tests or mill test reports as specified or required.
- I. Furnish incidental labor and facilities:
 1. **To provide access to Work to be tested.**
 2. **To obtain and handle samples at Project site or at source of product to be tested.**
 3. **To facilitate inspections and tests.**
 4. **For storage and curing of test samples.**
- J. Notify Owner's Representative, Owner, and laboratory 48 hours prior to expected time for operations requiring inspection and testing services.
- K. When inspections or tests can not be performed after proper notification and at no fault of laboratory, reimbursement costs for laboratory expenses incurred will be charged to Contractor by deducting charges from Contract Sum.

1.10 SUBMITTALS

- A. Provide submittals in accordance with Section 01 32 19
- B. Laboratory Reports:
 1. **Submit test reports within 2 weeks of test date.**
 2. **After each inspection and test, promptly submit copies of written reports as follows:**

- a. Owner: One copy.
- b. Owner's Representative: 3 copies.
- c. Code Officials: One copy.
- d. Contractor: 3 copies.

3. When requested by Owner's Representative, provide interpretation of test results and suggested remedies.

1.11 FAILURES AND RETESTING

- A. When initial inspections and tests indicate Work does not comply with Contract Documents, subsequent testing will be performed by same Testing Agency and will be done at Contractor's expense and deducted from Contract Sum.
- B. Removal and replacement of Work necessitated by such non-compliance of Contract Documents shall be at Contractor's expense.

PART 2: PRODUCTS and PART 3: EXECUTION

Not Used

END OF SECTION

01 51 17 – FIRE PROTECTION**PART 4:GENERAL (Municipal Fire Department Requirements)**

4.1 RELATED DOCUMENTS

- A. Related Documents: Provisions established in General and Supplementary Conditions of the Contract, Division 1 General Requirements, and the Drawings are collectively applicable to this Section.

4.2 INVESTIGATION

- A. An investigation of project conditions by the city Fire-Authority results in mitigation measures which are enforceable and shall be a part of contractual obligations.
- B. The General Contractor shall review all aspects and list of conditions and compare items with contract documents, specifications and drawings for compliance.
- C. The General Contractor will be responsible for verification and city requirements.

4.3 REPORT

- A. A copy of the full list of requirements is identified in Part 2
- B. Report is for Contractor's information but is not a warranty of all required city fire department conditions. Contact Montclair Fire Department for complete requirements.

4.4 RESPONSIBILITY

- A. Bidders are expected to examine the site and reports and then decide for themselves the character and nature to be encountered.
- B. The Owner's Representative and Owner assume no responsibility for variations of requirements and conditions.

PART 5: CITY FIRE DEPARTMENT REQUIREMENTS

- 5.1 The developer / general contractor is to be responsible for reasonable periodic clean-up of the construction site to avoid hazardous accumulation of combustible trash and debris.
- 5.2 Planter areas in the center of drives and adjacent to entrances should be of low profile type, not to exceed eight feet in height when mature.
- 5.3 The inside turning radius for an access road shall be 32 feet or greater. The outside turning radius for an access road shall be 45 feet or greater.
- 5.4 Signs shall be designed and mounted in accordance with Rancho Mirage and riverside County Fire Department standards.
- 5.5 The commercial development requires an approved automatic fire sprinkler system. The system shall conform to all local and national standards. Three complete sets of the sprinkler system plans shall be submitted directly to the Fire Marshal's Office for approval prior to installation of the system in commercial structures. The system shall be equipped with an automatic fuel shutoff to all equipment protected by this system.
- 5.6 Three complete sets of drawings of this system shall be submitted to the Fire marshal's Office prior to issuance of a permit.
- 5.7 Certificate of Occupancy by the Building Official shall be contingent upon Fire Department inspection and approval of all conditions.
- 5.8 Commercial occupancies shall install approved emergency lighting to provide adequate illumination in the event of any interruption of normal lighting.
- 5.9 An approved emergency keyed access system shall be required to facilitate access to buildings or gates by Fire Department personnel in the event of an emergency during non-business hours. Forms are available at the Montclair Fire Department headquarters for those occupancies requiring such a system. Facilities

□City of Rancho Mirage City Project No. CP15-315 Rancho Mirage Observatory□
with gated drive approaches shall contact the Fire Marshal's office for additional key and strobe requirements.

5.10 All City / County Fire department fees are due prior to any permit issuance.

END OF DOCUMENT

01 60 00 – PRODUCT REQUIREMENTS

PART 1:GENERAL

1.1 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.
- When specified products are available only from sources that do not or cannot produce a quantity adequate to complete project requirements in a timely manner, consult with the Owner's Representative for a determination of the most important product qualities before proceeding. Qualities may include attributes relating to visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources whose products possess these qualities, to the fullest extent possible.**
- B. CAL Green: Building materials with visible signs of water damage shall not be installed.
- Wall and floor framing shall not be enclosed when the framing members exceed 19% moisture content.**
 - Moisture content shall be determined with either a probe-type or a contact-type moisture meter.**
 - Moisture readings shall be taken at a point 2 feet to 4 feet from the grade stamped end of each piece to be verified.**
 - At least three random moisture readings shall be performed on wall and floor framing with documentation acceptable to the enforcing agency provided at the time of approval to enclose the wall or other framing.**
 - All insulation products which are visibly wet or have a high moisture content shall be replaced or allowed to dry prior to enclosure in wall or other cavities. Wet applied insulation products shall follow the manufacturer's' drying recommendations prior to enclosure.**
- C. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
- D. Matching of Colors:
- When a product is listed in the specifications with an accompanying color, pattern, texture, or sheen, provide only that product, or one that is identical in color, pattern, texture, and sheen to the product specified, regardless if the color, pattern, texture, or sheen of the alternate manufacturer's product is a standard or option.**
 - On finished materials and products, verify that colors, patterns, textures, and sheens are identical for the entire project and that there are no visual differences between batches, packages, bundles, or shipments, due to differing production runs. Owner's Representative reserves the right to reject products and materials installed, which have, in the sole opinion of the Owner's Representative, a significant enough difference in color, pattern, texture, or sheen, from other products on the project, so as to be visually distracting.**

1.2 SUBSTITUTIONS

- A. Limitations:
- During Bidding period, Instructions to Bidders govern times for submitting requests for substitutions under requirements specified in this Section.**
 - Requests for substitutions of products will be considered only within 30 days after date established in Notice to Proceed. Subsequent requests will be considered only in case of product unavailability or other conditions beyond control of Contractor.**
 - Substitutions will not be considered:**
 - When indicated on shop drawings or product data submittal without separate formal request.
 - When requested directly by subcontractor or supplier.
 - When acceptance will require substantial revision of Contract Documents.
 - Do not order or install proposed substitute products without written acceptance.**
 - Only one request for substitution for each product will be considered. When substitution is not accepted, provide specified product.**

- 6. Owner's Representative will determine acceptability of substitutions.**
- B. Requests for Substitutions:
- 1. Submit separate request for each substitution. Document each request with complete data substantiating compliance of proposed substitution with requirements of Contract Documents. Utilize substitution request form attached.**
 - 2. Identify product by Specifications section and Article numbers. Provide manufacturer's name and address, trade name of product, and model or catalog number. List fabricators and suppliers as appropriate.**
 - 3. Attach product data as specified in Section 01330.**
 - 4. List similar projects using product, dates of installation, and names of Owner's Representative and Owner.**
 - 5. Give itemized comparison of proposed substitution with specified product, listing variations, and reference to Specifications section and Article numbers.**
 - 6. Give quality and performance comparison between proposed substitution and the specified product.**
 - 7. Give cost data comparing proposed substitution with specified product, and amount of net change to Contract Sum.**
 - 8. List availability of maintenance services and replacement materials.**
 - 9. State effect of substitution on construction schedule, and changes required in other work or products.**
- C. Contractor Representation:
- 1. Request for substitution constitutes a representation that Contractor has investigated proposed product and has determined that it is equal to or superior in all respects to specified product or that the cost reduction offered, if any, is ample justification for accepting the offered substitution.**
 - 2. Provide same warranty for substitution as for specified product.**
 - 3. Coordinate installation of accepted substitute, making such changes as may be required for Work to be complete in all respects.**
 - 4. Certifies that cost data presented is complete and includes related costs under this Contract.**
 - 5. Waives claims for additional costs related to substitution which may later become apparent.**
- D. Submittal Procedures:
- 1. Submit 3 copies of request for substitution.**
 - 2. Owner's Representative will review Contractor's requests for substitutions with reasonable promptness.**
 - 3. During the bidding period, Owner's Representative will record acceptable substitutions in Addenda.**
 - 4. After award of Contract, Owner's Representative will notify Contractor, in writing, of decision to accept or reject requested substitution, generally within 14 days.**
 - 5. For accepted products, submit shop drawings, product data, and samples.**

PART 2:PRODUCTS

2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
- 1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.**
 - 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.**
- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:
- 1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.**
 - 2. Semi-Proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.**

- a. Where products or manufacturers are specified by name, comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
3. **Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.**
4. **Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirement**
5. **Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.**
 - a. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
6. **Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.**
7. **Visual Matching: Where Specifications require matching an established Sample, the Owner's Representative's decision will be final on whether a proposed product matches satisfactorily**
 - a. Where no product available within the specified category matches satisfactorily and also complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category, or for noncompliance with specified requirements.
8. **Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Owner's Representative will select the color, pattern and texture from the product line selected.**

PART 3: EXECUTION

3.1 PACKAGING AND TRANSPORTATION

- A. Require supplier to package products in boxes or crates for protection during shipment, handling, and storage. Protect sensitive products against exposure to elements and moisture.
- B. Protect sensitive equipment and finishes against impact, abrasion, and other damage.

3.2 DELIVERY, RECEIVING, AND HANDLING

- A. Deliver, receive, and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft
- B. Delivery:
 1. **Arrange deliveries of products in accordance with construction progress schedules. Allow time for inspection prior to installation.**
 2. **Coordinate deliveries to avoid conflict with Work and conditions at site; limitations on storage space; availability of personnel and handling equipment, and Owner's use of premises.**
 3. **Schedule delivery to minimize long-term storage at site and to prevent overcrowding of construction spaces.**
 4. **Deliver products in undamaged, dry condition, in original unopened containers or packaging with identifying labels intact and legible, complete with labels and instructions for handling, storing, unpacking, protecting and installing.**
 5. **Clearly mark partial deliveries of component parts of equipment to identify equipment and contents to permit easy accumulation of parts and to facilitate assembly.**
- C. Receiving and Handling:
 1. **Provide equipment and personnel to handle products, including those provided by Owner, by methods to prevent soiling and damage.**

2. **Provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.**
3. **Handle product by methods to avoid bending or oversteering. Lift large and heavy components only at designated lift points.**
4. **Immediately on delivery, inspect shipment to assure:**
 - a. Product complies with requirements of Contract Documents and reviewed submittal.
 - b. Quantities are correct.
 - c. Accessories and installation hardware are correct.
 - d. Containers and packages are intact and labels legible.
 - e. Products are protected and undamaged.

3.3 STORAGE

A. General:

1. **Store products, immediately on delivery, in accordance with manufacturer's instructions, with seals and labels intact. Protect until installed.**
2. **Arrange storage in a manner to provide access for maintenance of stored items and for inspection.**
3. **Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.**

B. Enclosed Storage:

1. **Store products, subject to damage by the elements, in substantial weathertight enclosures.**
2. **Maintain temperature and humidity within ranges stated in manufacturer's instructions.**
3. **Provide humidity control and ventilation for sensitive products as required by manufacturer's instructions.**
4. **Store unpacked and loose products on shelves, in bins, or in neat groups of like items.**

C. Exterior Storage:

1. **Provide substantial platforms, blocking, or skids, to support fabricated products above ground; slope to provide drainage. Protect products from soiling and staining.**
2. **For products subject to discoloration or deterioration from exposure to the elements, cover with impervious sheet material. Provide ventilation to avoid condensation.**
3. **Store loose granular materials on clean, solid surfaces such as pavement, or on rigid sheet materials, to prevent mixing with foreign matter.**
4. **Provide surface drainage to prevent erosion and ponding of water.**
5. **Prevent mixing of refuse or chemically injurious materials or liquids.**

END OF SECTION

SUBSTITUTION REQUEST FORM

DATE: _____

Owner's Representative's Project No: _____

Project: _____

To _____ From: _____

Contractor (Bidder) hereby request acceptance of the following product or system as substitution in accordance with provisions of Section 01600 of the Specifications:

1. SPECIFIED PRODUCT OR SYSTEM:

Substitution request for : _____

Specification Section No : _____ Article: _____

2. SUPPORTING DATA:

_____ Product data adequate for evaluation of the request for proposed substitution is attached (description of product, reference standard, performance and test data, specifications, drawings, photographs).

_____ Sample is attached.

_____ Sample will be sent if requested.

3. QUALITY COMPARISON

	SPECIFIED PRODUCT	SUBSTITUTION
Name, Brand:	_____	_____
Catalog No.:	_____	_____
Manufacturer:	_____	_____
Vendor:	_____	_____
Significant Variations:	_____	_____

(Add Additional Sheets If Necessary)

Maintenance Service Available: Yes _____ No _____

Spare Parts Source: _____

Warranty Provided: Yes _____ No _____ Years _____

By Whom: _____

4. PREVIOUS INSTALLATIONS:

Identification of similar projects on which proposed substitution was used:

City of Rancho Mirage City Project No. CP15-315 Rancho Mirage Observatory
 Project _____ Architect: _____
 Address: _____ Owner: _____
 Date Installed: _____

5. REASON FOR NOT GIVING PRIORITY TO SPECIFIED ITEMS:

6. EFFECT OF SUBSTITUTION:

Does the proposed substitution affect other work (adverse or otherwise): No _____ Yes _____
 (if yes, explain)

Substitution Changes Contract Time: No _____ Yes _____ Add/Deduct _____ Days

Substitution requires dimensional revisions or redesign of the work: No _____ Yes _____
 (if yes, attach explanation data)

Saving of credit to Owner: \$ _____

Extra Cost to Owner: \$ _____

7. CONTRACTOR'S (BIDDER'S) STATEMENT OF CONFORMANCE OF PROPOSED SUBSTITUTION TO CONTRACT DOCUMENTS:

I/we have investigated the proposed substitution. I/we:

- believe that it is equal or superior in all respects including function, appearance and quality to specified product, except as stated above;
- will provide same warranty and servicing requirements as specified for specified product;
- have included complete cost data and implications of the substitution;
- will pay for changes to the building design and special inspection costs caused by the use of this product;
- will coordinate the incorporation of the proposed substitution in the work;
- waive future claims for added cost to Contract caused by the substitution.

Contractor (Bidder): _____

Date: _____ By: _____

Answer all questions and complete all blanks - use "NA" if not applicable. Unresponsive or incomplete request will be rejected.

=====

OWNER'S REPRESENTATIVE'S REVIEW AND ACTION

_____ Resubmit substitution request

Provide more information in the following areas:

_____ Sign Contractor's (Bidder's) Statement of Conformance

_____ Substitution is accepted.

_____ Substitution is accepted, with the following comments:

_____ Substitution rejected.

_____ Substitution Request received too late.

Owner's Representative

Date: _____

01 74 13 – PROGRESS CLEANING

PART 1: GENERAL

1.1 CLEANING DURING CONSTRUCTION

- A. Control accumulation of waste materials and rubbish; periodically dispose of off-site.
- B. Keep site and construction areas clean on a weekly basis.
- C. Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

1.2 FINAL CLEANING

- A. Execute cleaning prior to inspection for Substantial Completion of the Work.

PART 2: PRODUCTS

2.1 CLEANING MATERIALS

- A. Use materials which will not create hazards to health or property, and which will not damage surfaces.
- B. Use only materials and methods recommended by manufacturer of material being cleaned.

PART 3: EXECUTION

3.1 CLEANING

- A. In addition to removal of debris and cleaning specified in other sections, clean interior and exterior exposed-to-view surfaces.
- B. Remove waste, foreign matter, and debris from roofs, gutters, area ways, and drainage systems.
- C. Cleaning during Construction:
 - 1. **Execute periodic cleaning to keep building, site, and adjacent properties free of accumulations of waste materials, debris, rubbish, and wind blown debris resulting from construction operations.**
 - 2. **Prior to Substantial Completion remove construction tools, scaffolding, equipment, machinery, and surplus materials.**
 - 3. **Broom clean and vacuum interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.**
 - 4. **Schedule cleaning operations so that dust and other contaminants will not fall on or adhere to wet or newly-coated surfaces.**
 - 5. **Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing space.**
 - 6. **Store volatile wastes in covered metal containers and remove from premises daily. Prevent accumulation of waste which creates hazardous conditions. Provide adequate ventilation during use of volatile or noxious substances.**
 - 7. **Collect and remove waste materials, debris, and rubbish from site weekly until execution of final cleaning and dispose off site in lawful manner.**
 - 8. **Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.**
 - 9. **Do not burn or bury rubbish and waste materials on Project site. Do not dispose of volatile wastes or hazardous materials such as mineral spirits, oil, or paint thinner in storm or sanitary drains. Do not dispose of wastes into streams or waterways.**
 - 10. **Maintain cleaning until Final Completion.**
- D. Final Cleaning: In addition to cleaning during construction, prior to Substantial Completion provide the following:
 - 1. **Remove temporary protection and labels not required to remain.**
 - 2. **Clean finishes free of dust, stains, films and other foreign substances.**
 - 3. **Clean transparent and glossy materials to a polished condition; remove foreign substances. Polish reflective surfaces to a clear shine.**
 - 4. **Clean, damp mop, wax, and polish resilient and hard- surface floor as specified.**
 - 5. **Clean surfaces of equipment; remove excess lubrication.**
 - 6. **Clean plumbing fixtures, and food service equipment, to a sanitary condition.**
 - 7. **Clean permanent filters of ventilating equipment and replace disposable filters when units have been operated during construction; in addition, clean ducts, blowers, and coils when units have been operated without filters during construction.**

- 8. Clean light fixtures and lamps.**
- 9. Remove waste, debris, and surplus materials from site. Clean grounds; remove stains, spills, and foreign substances from paved areas and sweep clean. Rake clean other exterior surfaces.**

END OF SECTION

01 77 19 – CLOSEOUT REQUIREMENTS

PART 1: WORK SPECIFIED HEREIN

- 1.1 All requirements in this section are procedures for submittal of pertinent data relating to closing out the Project upon completion of the work. Refer to Section 01 78 00 for additional submittal requirements.
- 1.2 Detailed instructions elsewhere in these Specifications may require that certain items listed herein be submitted prior to Substantial Completion.
- 1.3 Completion of the Project Summary: This Section is complementary to the General Conditions and Supplementary General Conditions and nothing herein shall be considered to waive any requirements of the General Conditions or Supplementary General Conditions.
- 1.4 Receipt/review and acceptance of all items specified in this Section is a prerequisite for final payment.

PART 2: RECORD DRAWINGS

- 2.1 General Contractor shall provide reproducible Record Drawings at his cost. Original Construction drawings may be purchased from the Architect for Five Hundred Dollars (\$500.00) or reproduced from the construction set by the Contractor at his discretion which shall clearly show all differences between the Contract for Construction as drawn and as installed for all work, as well as work added to the Contract for Construction which is not shown on the Drawings.
- 2.2 General Contractor shall maintain a set of Record Drawings at the job site and shall, within thirty (30) days after substantial completion of the project provide the Architect with record drawings. These shall be kept legible and current and shall be available for inspection at all times by the Architect. Show all changes in the Contract work, or work added, on these Record Drawings in a contrasting color, including work changed by Addendum or Bulletin.
- 2.3 In showing changes in the work, or added work, use the same legends as were used on the Drawings. Indicate exact locations by dimensions and exact elevations given in job datum, by depth. Give dimensions from a permanent point. Give elevations to sewer and storm drainage lines to the invert elevation. Incorporate all accepted architectural A.S.I. and P.R. information as well as all other field changes into the record drawings.
- 2.4 Mechanical and electrical Record Drawings shall indicate exact routing of all piping, duct work, power and control wiring, etc., location and function of all controls and whether manual or automatic and normal amperage readings for all motors taken at the equipment under normal load conditions.
- 2.5 Record Drawings shall contain the names, addresses and phone number of the Subcontractors and shall be signed by the General Contractor on the front cover.
- 2.6 Architect shall review the Record Drawings and he shall be the sole judge of their acceptability.
- 2.7 Upon substantial completion of the work, transfer the information from the Record Drawings to reproducible sheets or other acceptable electronic medium, which the General Contractor shall purchase from the Architect.
- 2.8 Upon Substantial Completion of the Project work, submit Record Drawings to the Architect for review.
- 2.9 Upon receipt of notice of review of the Record Drawings, deliver them together with 2 sets of prints, to Owner.

PART 3: CLOSEOUT MANUAL

- 3.1 Prior to the substantial completion of the project and within 6 weeks after all shop drawings have been submitted and approved, the General Contractor shall submit one complete copy of the closeout manual to the Architect for preliminary review and approval.
- 3.2 Upon completion of the Project the General Contractor shall submit to the Architect 3 complete ring bound 8-1/2" x 11" (fold larger sheets) copies of the approved closeout manual (commercial quality with plastic covers). Submit 1 copy of manual Initially to Architect for review only.
- 3.3 Upon approval by Architect submit the balance of the manuals. The closeout manuals shall each include all information in accordance with the following outline:
 - (a) CERTIFICATE OF OCCUPANCY - Document issued by local governmental authority certifying that the building complies with the provisions of applicable statutes and regulations, and permitting occupancy for the designated use.
 - (b) WARRANTY - The General Contractor shall warranty all work to the Owner for a period of one

year from date of Certificate of Substantial Completion unless specified for a longer period. In the case of work performed by a Subcontractor, the General Contractor shall warranty the work to and in favor of the Owner. In addition, each subcontractor shall warranty their work for a period of 1 year, unless otherwise noted, after date of Certificate of Substantial Completion and repair work that proves to be defective in workmanship and/or materials due to above work without expense whatsoever to the Owner. Included, but are not necessarily limited to, are the following General Requirements.

- (1) General Contractor shall submit written guarantee to the Owner stating that all work has been performed in accordance with the drawings and specifications (and authorized change orders, if any).
- (2) General Contractor shall also guarantee all work against defects due to faulty workmanship or materials and shall agree that during the guarantee period he shall make all repairs necessitated by reason of faulty workmanship or materials promptly and at no cost to the Owner.
- (c) Compile specified warranties and bonds.
- (d) Compile specified service and maintenance contracts.
- (e) Co-execute submittals when so specified.
- (f) Review submittals to verify compliance with Contract Documents.
- (g) Submit to Architect for review and transmittal to Owner.
- (h) Related requirements in other parts of Project Manual:

PART 4 SUBMITTAL REQUIREMENTS

- 4.1 Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.
- 4.2 Number of original signed copies required: 2 each.
- 4.3 Table of Contents: Neatly typed, in orderly sequence, provide
 - A Product of work item
 - B Firm, with name of principal, address and telephone number.
 - C Scope
 - D Date of beginning of warranty, bond or service and maintenance contract
 - E Duration of warranty, bond for service maintenance contract.
 - F Provide information for Tenant's personnel: Proper procedures in case of failure.
 - G Instances, which might affect the validity of warranty or bond.
 - H General Contractor, name of responsible principal, address and telephone number.
- 4.4 Provide warranties for all subcontractors/manufacturers including but not limited to the following:
 - Termite Control
 - Cast-in-place Concrete
 - Unit Masonry
 - Metal Fabrications
 - Building Insulation
 - Roofing- 10 years labor / 20 years membrane (Full NDL Warranty)
 - Flashing and Sheet Metal
 - Sealants - 5 years
 - Metal Doors and Frames
 - Aluminum Entrances and Storefronts
 - Hardware
 - Glazing, Lathing, Plastering, Stucco
 - Gypsum Wallboard
 - Plumbing System
 - Mechanical System (5-yr. warranty on motor compressor)
 - Fire Protection Sprinkler System
 - Electrical System and Controls

PART 5 MANUALS**FIRE SPRINKLER SYSTEMS MANUAL**

Equipment list includes, but not limited to the following items for every piece of material and equipment supplied by the fire sprinkler systems vendor and installer.

1. Name, model and manufacturer.
2. Complete parts drawings and list.
3. Local supply for parts or replacement with addresses and telephone numbers.
4. Local service organizations for equipment with address and 24 hour telephone numbers.
5. All tags, inspection slips, etc., removed from equipment as shipped from the factory.
6. All approved shop drawings and/or submittals.
7. Maintenance instructions with schedule of frequency of lubrication, cleaning, adjusting, replacing etc.

MECHANICAL SYSTEMS MANUAL

Equipment list includes, but not limited to the following items for every piece of material and equipment supplied by the Mechanical Subcontractor.

NOTE: Include all California CAL Green and CEC compliance with acceptance forms, required signatures and accompanying manufacturer's data.

1. Name, model and manufacturer.
2. Complete parts drawings and list.
3. Local supply for parts or replacement with addresses and telephone numbers.
4. Local service organizations for equipment with address and 24 hour telephone numbers.
5. All tags, inspection slips, etc., removed from equipment as shipped from the factory.
6. All approved shop drawings and/or submittals.
7. Maintenance instructions with schedule of frequency of lubrication, cleaning, adjusting, replacing etc.

PLUMBING SYSTEMS MANUAL

Equipment list includes, but not limited to the following items for every piece of material and equipment supplied by the Mechanical Subcontractor.

NOTE: Include all California CAL Green and CEC compliance with acceptance forms, required signatures and accompanying manufacturer's data.

1. Name, model and manufacturer.
2. Complete parts drawings and list.
3. Local supply for parts or replacement with addresses and telephone numbers.
4. Local service organizations for equipment with address and 24 hour telephone numbers.
5. All tags, inspection slips, etc., removed from equipment as shipped from the factory.
6. All approved shop drawings and/or submittals.
7. Maintenance instructions with schedule of frequency of lubrication, cleaning, adjusting, replacing etc.

ELECTRICAL SYSTEMS MANUAL

Equipment include, but not limited to the following items for every piece of equipment supplied by the Electrical Systems Subcontractor.

NOTE: Include all California Cal Green and CEC compliance with acceptance forms, required signatures and accompanying manufacturer's data.

1. Name, model and manufacturer
2. Complete parts and list.
3. Local supply for parts or replacements with address and phone numbers
4. Local service organizations for equipment and addresses with 24 hour telephone numbers.
5. All approved shop drawings for submittals
6. Maintenance instructions and schedules of frequency of lubrication, cleaning, adjusting, replacing,etc.

PART 6: SEMI-FINAL AND FINAL INSPECTIONS

- 6.1 Closeout is hereby defined to include general requirements near end of contract time, in preparation for final acceptance, final payment, normal termination of contract, occupancy by Owner and similar actions evidencing completion of the work. Specific requirements for individual units of work are specific throughout this specification. Time of closeout is directly related to "Substantial Completion".
- 6.2 Request a semi-final inspection by the Architect to determine the status of completion. Such notice shall be given at least 3 days before the requested inspection date.

PART 7: PRE-REQUISITES TO SUBSTANTIAL COMPLETION

- 7.1 Prior to requesting Architect's inspection for Certification of Substantial Completion, complete the following and list known exceptions in request.
- A. In progress payment request, coincident with or first following date claimed, show either 100% completion for portion of work claimed as "substantially complete", or list incomplete items, value of incompleteness, and reasons for being incomplete.
 - B. Include supporting documentation for completion as indicated in these contract documents.
 - C. Submit statement showing accounting for changes to the Contract Sum.
 - D. Advise Tenant of pending insurance changeover requirements.
 - E. Submit specific warranties, workmanship / maintenance agreements, and final certifications. Additionally, include one copy for review of each required manual, including similar documents.
 - F. Obtain and submit releases enabling Tenant's full and unrestricted use of the work and access to services and utilities, including (where required) occupancy permits, operating certificates, and similar releases.
 - G. Deliver tools, spare parts, extra stocks of materials, and similar physical items to Owner.
 - H. Make final changeover of locks and transmit keys to Tenant, and advise Tenant's personnel of changeover in security provisions.
 - I. Complete start-up testing of systems, and instructions of Tenant's operating/maintenance personnel: Discontinue (or change-over) and remove from project site temporary facilities and services, along with construction tools and facilities, mock-ups, and similar events.
 - J. Complete final cleaning up requirements, including touch-up painting of marred surfaces.
 - K. Touch-up and otherwise repair and restore marred exposed finishes.
- 7.2 If the Architect finds that the Project is substantially complete, he will prepare a Certificate of Substantial Completion, AIA Document G-704, for the approval and acceptance of the General Contractor and the Owner, attaching thereto a list or "Punch List" of items to be completed or corrected.
- 7.3 If the Architect does not concur in the General Contractor's claim of Substantial Completion, he will so notify the General Contractor, and thereafter the General Contractor shall initiate a new request for (semi-final) inspection. As the General Contractor completes the "Punch List" of uncompleted or uncorrected items, he shall submit to the Architect for his review:
- A. Record Drawings / Closeout Manuals to be submitted by General Contractor - completed and initialed.
 - B. Pre-requisites to Final Acceptance
- 7.4 Prior to requesting Architect's final inspection for certification of final acceptance and final payment, as required by General Conditions, complete the following and list known exceptions (if any) in request:
- A. Submit final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 - B. Submit updated final statement; accounting for additional (final) changes to Contract Sum.
 - C. Submit certified copy of Architect's/Engineer's final punch-list of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, endorsed and dated by Architect/Engineer.
 - D. Submit final meter readings for utilities, measured record of stored fuel, and similar data as of time of substantial completion or when Tenant took possession of and responsibility for corresponding elements of the work (where applicable).
 - E. Revise and submit evidence of final, continuing insurance coverage complying with insurance requirements, as well as final warranties, guarantees, and maintenance agreements.
 - F. Submit completed maintenance stock sign-off sheet.
 - G. Final Health Department Approval (where applicable)

7.5 General Contractor shall call for final inspection after all construction has been completed, electric and/or gas is on, all equipment is operational and establishment has been thoroughly cleaned. Receive Health Department approval prior to store opening, where required.

PART 8: RE-INSPECTION PROCEDURES

- 8.1 Upon receipt of General Contractor's request for final inspection and that the work has been completed, include punch-list items resulting from earlier inspections, and incomplete items delayed because of acceptable circumstances, (subject to Owner and Architect approval), Architect will re-inspect work.
- 8.2 If the Project is complete and all "Punch List" items are completed and corrected, the Architect will Issue a final certificate of Payment".
- 8.3 After completion of the procedures outlined above the General Contractor shall submit his final application for payment in accordance with the Agreement, the General Conditions and Supplementary General Conditions.
- 8.4 If, because of acts or omissions of the General Contractor, the Architect is required to conduct more than one final inspection of the Project to review the "Punch List", he will charge the Owner for the additional services required and such costs will be deducted from the money still due the General Contractor.

PART 9 FINAL CHECKOUTS OF STRUCTURE AND EQUIPMENT WITH OWNER

- 9.1 Arrange for each installer of work requiring continuing maintenance or operation, to meet with Owner personnel, at the project site, to provide basic instructions by manufacturer's representatives where installers are not expert in the required procedures.
- 9.2 Review maintenance manuals, record documentation, tools, spare parts, and materials, lubricants, fuels, identification system, control sequences, hazards, cleaning and similar procedures and facilities.
- 9.3 For operational equipment, demonstrate start-up, shutdown, emergency operations, noise and vibration adjustments, safety, economy/efficiency adjustments, energy effectiveness, and similar operations.
- 9.4 Review maintenance and operations in relations with applicable warranties, agreements to maintain, bonds, and similar continuing commitments.
- 9.5 Note: Retention funds will not be paid until project closeout.

PART 10 SPARE PARTS AND MAINTENANCE MATERIALS

10.1 The General Contractor shall deliver to Owner the spare parts, extra stock and maintenance materials listed below, and the General Contractor shall complete the maintenance stock sign-off check list and provide to Owner Representative. Materials shall be neatly packaged and identified.

Section _____

09900Painting:

1 full gallon of each paint color used:

Received _____

15000Plumbing:

15202Distribution:

2 Plumbing Valve Charts
(Highlight All Water

_____ Valves on Sheets P-1 and P1-1) _____

1 complete change of all
filter media

15300Fire Protection: 1 head wrench

1 cabinet (large enough hold all heads)

2 each type head:

- A. Recessed (interior) _____
- B. Recessed (exterior) _____
- c. Upward Pendant (interior) _____
- D. Upward Pendant (exterior) _____
- E. Other as indicated _____

PART 11 ISSUANCE OF CERTIFICATE OF OCCUPANCY BY JURISDICTIONAL AUTHORITY

11.1 Utility release. The following minimum requirements shall be completed prior to any occupancy or utility connection:

- (1) Written clearance from the Fire and Public Works Departments and Planning and Business License Divisions.
- (2) Written clearance from Monte Vista Water District, NPDES Coordinator, and Environmental Manager, when applicable.
- (3) The following, when applicable:
 - (a) Electronic imaging of plans received.
 - (b) Verification of school fees paid.
 - (c) Grading certificate received.
 - (d) All plan review fees paid.
 - (e) Sewer assessment fees paid.
 - (f) Hazardous materials statements received.
 - (g) Subcontractor's list received.
 - (h) Parkland development fees received.
 - (i) Transportation development impact fees received

The General Contractor has delivered all spare parts and maintenance materials as defined above in a satisfactory condition and has reviewed the maintenance procedures with the Construction Manager and Owner's Representative.

This document is to be included in the closeout package and be fully executed.

Tenant Construction Manager

Date

Owner Representative

Date

END OF SECTION

01 78 00 – CLOSEOUT SUBMITTALS

PART 1:GENERAL

1.1 QUALITY ASSURANCE

- A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

1.2 PROJECT RECORD DOCUMENTS

- A. Maintenance of Documents and Samples:

1. **In addition to requirements in General Conditions, maintain at the site for Owner one record copy of:**
 - a. Contract Drawings.
 - b. Specifications.
 - c. Addenda.
 - d. Change Orders and other modifications to the Contract.
 - e. Reviewed shop drawings, product data, and samples.
 - f. Field test records.
 - g. Inspection certificates.
 - h. Manufacturer's certificates.
2. **Store Record Documents and samples in Field Office apart from documents used for construction. Provide files, racks, and secure storage for Record Documents and samples.**
3. **Label and file Record Documents and samples in accordance with Section number listings in Table of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.**
4. **Maintain Record Documents in a clean, dry and legible condition. Do not use Record Documents for construction purposes.**
5. **Keep Record Documents and samples available for inspection by Owner's Representative.**

- B. Recording:

1. **Record information on a set of blue line opaque drawings, and in a copy of a Project Manual.**
2. **Provide felt tip marking pens, maintaining separate colors for each major system, for recording information.**
3. **Record information concurrently with construction progress. Do not conceal any work until required information is recorded.**
4. **Contract Drawings and Shop Drawings: Legibly mark each item to record actual construction, including:**
 - a. Measured depths of elements of foundation in relation to finish first floor datum.
 - b. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - c. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction.
 - d. Field changes of dimension and detail.
 - e. Changes made by Modifications.
 - f. Details not on original Contract Drawings.
 - g. References to related shop drawings and Modifications.
5. **Specifications: Legibly mark each item to record actual construction, including:**
 - a. Manufacturer, trade name, and catalog number of each product actually installed, particularly optional items and substitute items.
 - b. Changes made by Addenda and Modifications.
6. **Other Documents: Maintain manufacturer's certifications, inspection certifications, field test records, and other documents required by individual Specifications sections.**

1.3 OPERATION AND MAINTENANCE MANUALS

- A. Contents

1. **Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Owner's Representative and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.**

2. **For Each Product or System: List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.**
 3. **Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.**
 4. **Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.**
 5. **Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 16.**
 6. **Warranties and Bonds: Bind in copy of each.**
- B. **Manual for Materials and Finishes:**
1. **Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured products.**
 2. **Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.**
 3. **Moisture-protection and Weather-exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.**
 4. **Additional Requirements: As Specified in individual Specifications sections.**
 5. **Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.**
- C. **Manual for Equipment and Systems:**
1. **Each Item of Equipment and Each System: Include description of unit or system, and component parts. Give function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.**
 2. **Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications.**
 3. **Include as-installed color coded wiring diagrams.**
 4. **Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.**
 5. **Maintenance Requirements: Include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.**
 6. **Provide servicing and lubrication schedule, and list of lubricants required.**
 7. **Include manufacturer's printed operation and maintenance instructions.**
 8. **Include sequence of operation by controls manufacturer.**
 9. **Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.**
 10. **Provide as-installed control diagrams by controls manufacturer.**
 11. **Provide Contractor's coordination drawings, with as- installed color coded piping diagrams.**
 12. **Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.**
 13. **Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.**
 14. **Include test and balancing reports as specified in individual specification sections.**
 15. **Additional Requirements: As specified in individual Specifications sections.**
 16. **Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.**
- D. **Instruction of Owner Personnel:**
1. **Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times. For equipment requiring seasonal operation, perform instructions for other seasons within 6 months.**
 2. **Refer to Section 01820.**

E. Submittals:

1. **Submit 2 copies of preliminary draft or proposed formats and outlines of contents before start of Work. Owner's Representative will review draft and return one copy with comments.**

1.4 WARRANTIES AND BONDS

A. Preparation

1. **Obtain warranties and bonds, executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.**
2. **Verify that documents are in proper form, contain full information, and are notarized.**
3. **Co-execute submittals when required.**
4. **Retain warranties and bonds until time specified for submittal.**

1.5 SPARE PARTS, OVERAGES, AND MAINTENANCE MATERIALS

A. Products Required:

1. **Provide quantities of products, spare parts, maintenance tools, and maintenance materials specified in individual sections to be provided to Owner, in addition to that required for completion of Work.**
2. **Products: Identical to those installed in the Work. Include quantities in original purchase from manufacturer to avoid variations in manufacture.**

B. Storage, Maintenance:

1. **Store products with products to be installed in the Work, under provisions of Section 01 60 00.**
2. **Maintain spare products in original containers with labels intact and legible, until delivery to Owner.**

C. Delivery:

1. **Coordinate with Owner: Deliver and unload spare products to Owner at Project site and obtain receipt prior to final payment.**

PART 2:PRODUCTS and PART 3: EXECUTION

Not Used

END OF SECTION

01 79 00 – DEMONSTRATION & TRAINING**PART 1: GENERAL**

1.1 QUALITY ASSURANCE

- A. When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstrations and instructions have been completed.
- B. Coordinate all data as required with owner's building commissioner.
- C. Owner will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.2 SUBMITTALS

- A. Submit preliminary schedule for Owner's approval, listing times and dates for demonstration of each item of equipment and each system, 2 weeks prior to proposed dates.
- B. Submit reports within one week after completion of demonstrations, that demonstrations and instructions have been satisfactorily completed. Give time and date of each demonstration, with a list of persons present.

PART 2: PRODUCTS – not used**PART 3: EXECUTION**

3.1 PREPARATION

- A. Verify equipment has been inspected and put into operation in accordance with Section 01 75 00; testing, adjusting, and balancing has been performed in accordance with 01 33 19 and equipment and systems are fully operational.
- B. Have copies of completed operation and maintenance manuals at hand for use in demonstrations and instructions.

3.2 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of equipment and systems to Owner's personnel 2 weeks prior to date of final inspection. For equipment requiring seasonal operation, perform instructions for other seasons within 6 months.
- B. Use operation and maintenance manuals as basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at designated location.
- D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

END OF SECTION

01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS

CAL-Green SUMMATION-CHECKLIST

PART 6: GENERAL

6.1 RELATED DOCUMENTS

- A. Related Documents: Provisions established in General and Supplementary Conditions of the Contract, Division 1 General Requirements, and the Drawings are collectively applicable to this Section.
 1. **Refer to all Mandatory Compliance Notes and Details on drawings.**
 2. **Comply with all applicable 2013 CAL Green code requirements**
- B. Refer to CAL Green Compliance Form – Owner's Project Requirements (OPR).
- C. Refer to Reference Standards Attachment Form in Project Manual Exhibits.

6.2 INVESTIGATION

- A. An examination of nonresidential mandatory measures is contractual conditions at the building site. These investigations are to be checked and verified. The following depicts mitigations and are to be enforced whether clearly depicted on drawings and specifications or not. As a guide, measures are herein made, and identified in the Drawings and Specifications.
- B. Regulations and the code's intent is to encourage buildings to achieve exemplary performance in the area of energy efficiency. The California Energy Commission believes specifically that a *green building* should achieve at least 15 percent reduction in energy usage when compared to the State's mandatory energy efficiency standards.

PART 7: COMPLIANCE MITIGATION MEASURES

7.1 SITE PLANNING & DESIGN

- A. Storm Water Drainage & Retention (SWRCB: California State Water Resources Control Board):
VERIFY COMPLIANCE WITH AUTHORITY.
 1. **Helps prevent flooding of adjacent property and prevent pollution from storm water runoff by retaining soil on-site or by providing filtering to restrict sedimentation from reaching storm water drainage systems and receiving streams and rivers.**
 2. **Establishes criteria for a plan to manage storm water drainage during construction.**
 - a. Retention basin are sized and depicted on the civil site plan drawings
 - b. Civil design filters storm water and routes to public drainage system
 - c. Compliance with local storm water ordinance is per WQMP
 - d. Prevention of soil loss by storm or wind erosion per civil drawings
 - e. Prevention of sedimentation and/or dust/particulate matter (air pollution)
 3. **Surface Drainage Aspects**
 - a. Requires planning of the surface drainage system serving the site
 - b. The site shall be planned to keep water from entering buildings.
 - c. Construction drawings indicates how surface drainage will be managed
 - d. Drainage system includes swales, drain piping, retention areas, and ground water recharge
- B. Energy Efficiency (Minimum Performance for ALL TYPES Construction)
 1. **(CEC) California Energy Commission adopts regulations to establish minimum levels of energy efficiency that a conditioned structure must meet or exceed.**
 2. **Performance is based on a Prescriptive Method or Performance Method (computer analysis) per filled out forms on drawings.**
 3. **Water savings: Requires a 20 percent reduction of indoor water use per plumbing fixture schedules and specifications.**
 4. **Separate sub-meters required for...**
 - a. Individual leased tenant space projected to consume more than 100 gal / day of water.
 - b. Laundry, cleaners, restaurant food service, medical, dental, beauty salon or barber shop requires meters.
 5. **Wastewater to be reduced 20 percent for each building**
 - a. Install water-conserving fixtures (water closets, urinals, etc.)
 - b. Utilize non-potable water systems
- C. Site Improvement Efficiency Measures
 1. **Irrigation Controllers**

- a. Requires irrigation controls to be weather or soil moisture based and automatically adjust irrigation in response to changes in plants' needs as weather conditions change, or have rain sensors or communication systems that account for local rainfall.
- b. Weather-based controllers without integral rain sensors or communication systems that account for local rainfall shall have a separate wired or wireless rain sensor which connects or communicates with the controller(s).
- c. Soil moisture-based controllers are not required to have rain sensor input.
- d. Automatically delay watering cycle due to rain
 1. Communication based
 2. Water needs based
 3. Based on soil moisture

2. Water Budget

- a. A water budget is developed for landscape irrigation that complies with local ordinance and the California Department of Water Resources Model Water Efficient Landscape Ordinance.
- b. Prescriptive measures assist in compliance.
- c. For landscaped areas up to 5000 square feet, separate meters or sub-meters shall be installed for indoor and outdoor potable water use. Install irrigation controllers and sensors.

7.2 RESOURCE EFFICIENCY FOR ALL DESIGN

- A. Joints and Openings (between conditioned and unconditioned spaces)
 1. **Openings in the building envelope need to accommodate gas, plumbing, electrical lines and other necessary penetrations which must be sealed in compliance with the California Energy Code.**
 2. **Exception: Annular spaces around pipes, electric cables, conduits, or other openings in plates at exterior walls (protected against passage of rodents) to be sealed with cement mortar or similar methods.**
 - a. Use metal plates or covers
 - b. Use cementitious material to seal opening
 - c. Use other methods approved by the enforcing agency
- B. Construction Waste (Waste Management Plan)
 1. **Requires at least 50% of non-hazardous construction and demolition debris to be recycled and/or salvaged.**
 2. **Or compliance with a local waste ordinance that is more stringent.**
 3. **Soil and land clearing debris are exempt. 100 percent of trees, stumps, rocks and associated vegetation and soils resulting primarily from land clearing shall be reused or recycled. For a phased project, such material may be stockpiled on site until the storage site is developed.**
 4. **Alternative methods or exceptions may be approved due to local constraints.**
 5. **Develop a waste management plan and submit for approval to the enforcing agency.**
 6. **Provide readily accessible areas that serve the entire building and are identified for the depositing, storage, and collection of non-hazardous materials for recycling, including (at a minimum): paper, corrugated cardboard, glass, plastics, metals, etc.**
 7. **Space allocation for recycling areas shall comply with Chapter 18, Part 3, Division 30 of the Public Resources Code. Chapter 18 is known as the California Solid Waste Reuse and Recycling Access Act of 1991.**
 8. **Provide documentation of compliance: Calculate the amount of materials diverted by weight or volume, but not by both.**
- C. Light Pollution Reduction
 1. **Comply with lighting power requirements in the California Energy Code, CCR, Part 6, and design interior and exterior lighting such that zero direct-beam illumination leaves the building site.**
 2. **Meet or exceed exterior light levels and uniformity ratios for lighting zones 1-4 as defined in Chapter 10 of the California Administrative Code, CCR, Part 1.**
 - a. Shield all exterior luminaires or provide cutoff luminaires
 - b. Contain interior lighting within each source
 - c. Allow no more than 0.01 horizontal lumen foot-candles to escape 15 feet beyond the site boundary.
 - d. Automatically control exterior lighting dusk to dawn to turn off or lower light levels during inactive periods.

7.3 OPERATION & MAINTENANCE (COMMISSIONING and MANUALS)

- A. Requires educational materials, operation and maintenance manuals to ensure buildings, grounds, and equipment are properly maintained.
- 1. Construction practices requires a level of knowledge to maintain building systems and equipment.**
 - 2. Additional information regarding landscape design and maintenance, recycle opportunities, special inspection reports, and energy incentive programs.**
- B. Testing and Adjusting (all buildings)
- 1. Testing and adjusting of systems shall be required for buildings less than 10,000 square feet as well as buildings requiring commissioning.**
 - 2. Develop a written plan of procedures for testing and adjusting systems.**
 - HVAC Systems and Controls
 - Indoor / outdoor lighting & controls
 - Water Heating Systems
 - Renewable Energy Systems
 - Landscape Irrigation Systems
 - Water Reuse Systems
 - 3. Perform testing and adjusting procedures in accordance with industry best practices and applicable standards on each system as determined by the building official.**
 - 4. The HVAC system shall be balanced in accordance with the procedure defined by the Testing Adjusting and Balancing Bureau National Standards; the National Environmental Balancing Bureau Procedural Standards; or Associated Air Balancing Council National Standards or as approved by the building official.**
 - 5. Provide the building owner or representative with detailed operating and maintenance instructions and copies of guaranties / warranties for each system. O & M instructions shall be consistent with OSHA requirements in CCR, Title 8, Section 5142, and other related regulations.**
 - 6. Include a copy of all inspection verifications and reports required by the enforcing agency.**
- C. Protection of systems and equipment during construction
- 1. Duct Openings: Protect from contamination during construction**
 - Air distribution component openings must be sealed with tape, plastic, sheet metal, etc.
 - Must be acceptable to enforcement agency to reduce amount of dust or debris collected in system
 - 2. Mechanical Equipment: Cover and protect until occupancy**
 - 3. Use plastic or sheet metal**
 - 4. Wrap or protect equipment stored on the jobsite for future installation.**
 - 5. If necessary- use alternative space conditioning during construction**
- D. Commissioning (Required for buildings exceeding 10,000 square feet)
- 1. Owners Project Requirements (OPR)**
 - 2. Basis of Design**
 - 3. Commissioning measures**
 - 4. Commissioning plan**
 - 5. Functional Performance Testing**
 - 6. Documentation and Training**
 - 7. Commissioning Report**

7.4 FINISH MATERIAL POLLUTANT CONTROL

- A. Limits pollutants from the off-gassing of finish materials
- B. Tables are provided establishing limits on the emissions of
- C. VOCs in adhesives, paints, and other coatings (SCAQMD & CCR)
- 1. VOC limitations for carpet, cushions, and pad adhesives**
 - 2. Address formaldehyde limits - California Air Resources Board (ARB).**
 - 3. Aerosol Paints & Coatings (regulations)**
 - 4. Ensures these levels are met by including a mandatory verification component which requires certification or documentation.**
- D. Finish Material Pollutant Control
- 1. Collect material specification sheets and make them available at time of inspection.**
 - 2. Protect Product Labels**
 - 3. Carpet systems – 100% Green Label Plus**
 - 4. Composite wood products – Air Resources Board standards**
 - 5. Resilient Flooring – 50% requires CHPS criteria**

E. Verification of compliance is required at the request of enforcement agency. Documentation includes...

1. **Manufacturer's product specification**
2. **Field verification of on-site product containers**

7.5 ENVIRONMENTAL QUALITY

A. Concrete Slab Foundations

1. **Provides explicit requirements for the installation of vapor barriers in slab on grade foundations to address moisture and mold issues that can negatively affect indoor air quality as well damage to floor coverings.**
2. **Specifies an aggregate base as a capillary break and clarifies that the vapor retarder must be placed above the aggregate and in direct contact with the concrete slab.**
3. **Allows equivalent methods provided the same protections will be maintained.**

B. Moisture Content of Building Materials

1. **Requires the moisture content of construction materials and insulation to be verified prior to approval to enclose wall and floor cavities with drywall or other finishes.**
2. **CBC specifies maximum grading and mill certification levels of moisture in framing members.**
3. **Field verification and protection is required during wet weather. Cover all building materials.**
4. **Ensure the building is weather tight before insulating.**
5. **Ensure building materials are kept dry and test for moisture levels.**
6. **Toilet Exhaust Fans to be Energy Star compliant with Humidistat controls**

C. Weather Protection

1. **Provide a weather-resistant exterior wall and foundation envelope as required by California Building Code Section 1403.2 and California Energy Code Section 150, manufacturer's installation instructions, or local ordinance, whichever is more stringent.**
2. **Use features such as overhangs and recesses, and flashings integrated with a drainage plane.**
3. **Use non-absorbent floor and wall finishes within at least two feet around and perpendicular to such openings.**
4. **Design and maintain landscape irrigation systems to prevent spray on structures.**
5. **Design exterior entries and / or openings subject to foot traffic or wind-driven rain to prevent water intrusion into buildings.**

D. Filtration:

1. **In mechanically ventilated buildings, provide regularly occupied areas of the building with air filtration media for outside and return air prior to occupancy that provides at least a Minimum Efficiency Reporting Value (MERV) of 8.**
2. **Where outdoor areas are provided for smoking, prohibit smoking within 25 feet of building entries, outdoor air intakes and operable windows and in buildings; or as enforced by ordinances, regulations, or policies of any city, county, or campus, whichever are more stringent.**
3. **Post signage to inform building occupants of the prohibitions.**

E. Indoor Moisture Control

1. **Buildings shall meet or exceed the provisions of California Building Code, CCR, Title 24, Part 2, Sections 1203 (Ventilation) and Chapter 14 (Exterior Walls).**

F. Outside Air Delivery

1. **For mechanically or naturally ventilated spaces in buildings, meet the minimum requirements of Section 121 (Requirements for Ventilation) of the California Energy Code, CCR, Title 24, Part 6, or the applicable local code, whichever is more stringent, and Chapter 4 of CCR, Title 8.**
2. **For buildings equipped with demand control ventilation, CO2 sensors and ventilation controls shall be specified and installed in accordance with the requirements of the current edition of the California Energy Code, CCR, Title 24, Part 6, Section 121(c).**

G. Acoustical Control

1. **Employ building assemblies and components with Sound transmission Coefficient (STC) values determined in accordance with ASTM E90 and ASTM E413**
2. **Wall and roof-ceiling assemblies making up the building envelope shall have an STC of at least 50, and exterior windows shall have a minimum STC of 30.**
3. **Wall and floor-ceiling assemblies separating tenant spaces and tenant spaces with public spaces shall have an STC of at least 40.**

- City of Rancho Mirage City Project No. CP15-315 Rancho Mirage Observatory□
- H. Ozone Depletion & Greenhouse Gas Reductions
1. Installations of HVAC, refrigeration, and fire suppression equipment shall comply with Sections 5.508.1.1 and 5.508.1.2.
 2. Install HVAC, refrigeration and fire suppression equipment that do not contain CFCs.
 3. Install HVAC, refrigeration and fire suppression equipment that do not contain Halons

PART 8: SPECIAL INSPECTIONS AND INSTALLER QUALIFICATIONS

- 8.1 Installer Training:
- A. Certificate of training as a HVAC systems installer through a program acceptable to the enforcing agency
 - B. Or Work is performed under the direct supervision of a person with acceptable training
 - C. Or Acceptable Programs include:
 1. State Certifies Apprenticeship
 2. Trade / Labor-sponsored Training
 3. Public Utility Training
 4. Manufacturer-sponsored Training
 5. Other Programs Acceptable to Enforcing Agency
- 8.2 Special inspection:
- A. Enforcing agency can require that the owner employ one or more special inspectors to verify compliance.
 - B. Qualifications may include:
 1. Certification by a national or regional green building program or standard publisher.
 2. Certification by a statewide energy consulting or verification organization, such as HERS raters, BPI contractors, and home energy auditors.
 3. Successful completion of a 3rd party apprentice training program in the appropriate trade.
 4. Other programs acceptable to the enforcing agency.
 - C. Inspectors must be independent entities with no financial interest.
 - D. HERS raters are an example of 'special inspectors' certifies by the CEC.
- 8.3 Documentation:
- A. Verification of compliance includes construction documents, plans, specifications builder or installer certification, inspection reports, or other methods acceptable to the enforcing agency which show substantial conformance. Where specific documentation is necessary to verify compliance, that method of compliance will be specified in the appropriate section (or identified in the checklist).
 - B. Worksheets (calculation tables to be filled out)
 1. WS1- Baseline Water Use
 2. WS2- Water Use Reduction (20% reduction)
 3. WS3- Water Use Reduction (30%, 35% or 40%)
 4. CWM –Construction Waste Management (specifications)
 5. CWM- Material Worksheet
 6. CWM- Management Acknowledgement (construction waste)
 - C. Refer to 2013 CAL Green Mandatory Measures Checklist (follows)

MEASURES CHECKLIST (Effective January 1, 2014)

SECTION	CREDIT	REQUIREMENTS	Measures provided on plan sheet:
PLANNING AND DESIGN (Site Development)			
5.106.1	Storm Water Pollution Prevention Plan	Newly constructed projects which disturb less than one acre of land shall prevent the pollution of stormwater runoff from the construction activities through local ordinance in Section 5.106.1.1 or Best management practices (BMP) in Section 5.106.1.2	

5.106.4	Bicycle Parking	<p>Comply with Sections 5.106.4.1.1 and 5.106.4.1.2; or meet local ordinance, whichever is stricter.</p> <p>5.106.4.1.1 Short-Term bicycle parking. If the new project or addition or alteration is anticipated to generate visitor traffic, provide permanently anchored bicycle racks within 200 ft of the visitors' entrance, readily visible to passers-by, for 5 percent of new visitor motorized vehicle parking spaces being added, with a minimum of one two-bike capacity rack. Exception: Additions or alterations which add 9 or less visitor parking spaces.</p> <p>5.106.4.1.2 Long-Term bicycle parking. For new buildings with over 10 tenant-occupants or for additions or alterations that add 10 or more tenant parking spaces, provide secure bicycle parking for 5 percent of tenant-occupied motorized vehicle parking spaces being added, with a minimum of one space.</p>	
5.106.5.2	Designated Parking	In new projects or additions or alterations that add 10 or more vehicular parking spaces, provide designated parking for any combination of low-emitting, fuel efficient, and carpool/van pool vehicles per Table 5.106.5.2.	
5.106.8	Light Pollution Reduction	<p>New outdoor lighting systems shall be designed and installed to comply with:</p> <ol style="list-style-type: none"> 1. The minimum requirements in the <i>California Energy Code</i> for Lighting Zones 1–4 as defined in Chapter 10 of the <i>California Administrative Code</i>; and 2. Backlight, Uplight and Glare (BUG) ratings defined in IESNA TM-15-11; and 3. Allowable BUG ratings not exceeding those shown in Table 5.106.8, or <p>Comply with a local ordinance lawfully enacted pursuant to Section 101.7, whichever is more stringent.</p> <p>Exceptions:</p> <ol style="list-style-type: none"> 1. Luminaires that qualify as exceptions in Section 147 of <i>Calif. Energy Code</i> 2. Emergency lighting 	
5.106.10	Grading and Paving	<p>Construction plans shall indicate how site grading or a drainage system will manage all surface water flows to keep water from entering buildings. Examples of methods to manage surface water include those shown in Items 1–5.</p> <p>Exceptions: Additions and alterations not altering the drainage path.</p>	

ENERGY EFFICIENCY

5.201.1	Scope	Building meets or exceeds the requirements of the <i>California Building Energy Efficiency Standards</i> .	
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WATER EFFICIENCY AND CONSERVATION (Indoor Water Use)

5.303.1	Meters	<p>Separate meters shall be installed for the uses described in Sections 5.303.1.1 and 5.303.1.2.</p> <p>5.303.1.1 New buildings or additions in excess of 50,000 square feet. Separate submeters shall be installed as follows: For each individual leased, rented or other tenant space within the building projected to consume more than 100 gal/day.</p> <ol style="list-style-type: none"> 2. Where separate submeters for individual building tenants are unfeasible, for water supplied to the following subsystems: <ol style="list-style-type: none"> a. Makeup water for cooling towers where flow through is greater than 500 gpm (30 L/s) b. Makeup water for evaporative coolers greater than 6 gpm (0.04 L/s) c. Steam and hot-water boilers with energy input more than 500,000 Btu/h (147 kW) <p>5.303.1.2 Excess consumption. Any tenant within a new building or an addition that is projected to consume more than 1,000 gal/day (3800 L/day).</p>	
5.303.2	Water Reduction	<p>Plumbing fixtures shall meet the maximum flow rate values shown in Table 5.303.2.3.</p> <p>Exception: Buildings that demonstrate 20% overall water use reduction. In this case, a calculation demonstrating a 20% reduction in the building "water use baseline", as establish in Table 5.303.2.2, shall be provided.</p> <p>5.303.2.1 Areas of additions or alteration. The provisions of Sections 5.303.2 and 5.303.3 shall apply to new fixtures in additions or areas of alterations to the building.</p>	
5.303.3	Water Conserving Plumbing Fixtures and	Plumbing fixtures (water closets and urinals) and fittings (faucets and showerheads) shall comply with the following:	

SECTION	CREDIT	REQUIREMENTS	Measures provided on plan sheet:
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	Fittings	<p>5.303.3.1 Water closets. The effective flush volume of all water closets shall not exceed 1.28 gallons per flush. Tank-type water closets shall be certified to the performance criteria of the U.S. EPA WaterSense Specification for Tank-Type Toilets. Note: The effective flush volume of dual flush toilets is defined as the composite, average flush volume of two reduced flushes and one full flush.</p> <p>5.303.3.2 Urinals. The effective flush volume of urinals shall not exceed 0.5 gallons per flush.</p> <p>5.303.3.3 Showerheads. 5.303.3.3.1 Single showerheads. Showerheads shall have a maximum flow rate of not more than 2.0 gallons per minute at 80 psi. Showerheads shall be certified to the performance criteria of the U.S. EPA WaterSense Specification for Showerheads. 5.303.3.3.2 Multiple showerheads serving one shower. When a shower is served by more than a showerhead, the combined flow rate of all showerheads and/or other shower outlets controlled by a single valve shall not exceed 2.0 gallons per minute at 80 psi, or the shower shall be designed to allow only one shower outlet to be in operation at a time. Note: A hand-held shower shall be considered a showerhead.</p>	
5.303.4	Wastewater Reduction	Each new building shall reduce the generation of wastewater by one of the following methods: 1. The installation of water-conserving fixtures or 2. Utilizing nonpotable water systems.	
5.303.6	Standards for Plumbing Fixtures and Fittings	Plumbing fixtures and fittings shall be installed in accordance with the <i>California Plumbing Code</i> , and shall meet the applicable standards referenced in Table 1401.1 of the <i>California Plumbing Code</i> and in Chapter 6 of this code.	

WATER EFFICIENCY AND CONSERVATION (Outdoor Water Use)

5.304.1	Water Budget	A water budget shall be developed for landscape irrigation use that installed in conjunction with a new building or an addition or alteration.	
5.304.2	Outdoor Potable Water Use	For new water service or for addition or alteration requiring upgraded water service for landscaped areas of at least 1,000 square feet but not more than 5,000 square feet, separate submeters or metering devices shall be installed for outdoor potable water use.	
5.304.3	Irrigation Design	<p>In new nonresidential construction or building addition or alteration with at least 1,000 square feet but not more than 2,500 square feet of cumulative landscaped area (the level at which the MWELO applies), install irrigation controllers and sensors which include the following criteria and meet manufacturer's recommendations.</p> <p>5.304.3.1 Irrigation controllers. Automatic irrigation system controllers installed at the time of final inspection shall comply with the following: 1. Controllers shall be weather- or soil moisture-based controllers that automatically adjust irrigation in response to changes in plants' needs as weather conditions change. 2. Weather-based controllers without integral rain sensors or communication systems that account for local rainfall shall have a separate wired or wireless rain sensor which connects or communicates with the controller(s). Soil moisture-based controllers are not required to have rain sensor input.</p>	

MATERIAL CONSERVATION & RESOURCE EFFICIENCY (Weather Resistance and Moisture Management)

5.407.1	Weather Protection	Provide a weather-resistant exterior wall and foundation envelope as required by <i>California Building Code</i> , Section 1403.2 and <i>California Energy Code</i> , Section 150, manufacturer's installation instructions or local ordinance, whichever is more stringent.	
5.407.2	Moisture Control	<p>Employ moisture control measures by the following methods; 5.407.2.1 Sprinklers. Prevent irrigation spray on structures. 5.407.2.2 Entries and openings. Design exterior entries and openings to prevent water intrusion into buildings as follows: 5.407.2.2.1 Exterior door protection. Primary exterior entries shall be covered to prevent water intrusion by using nonabsorbent floor and wall finishes within at least 2 feet around and perpendicular to such openings plus at least one of the following: 1. An installed awning at least 4 feet in depth. 2. The door is protected by a roof overhang at least 4 feet in depth. 3. The door is recessed at least 4 feet. 4. Other methods which provide equivalent protection. 5.407.2.2.2 Flashing.</p>	

SECTION	CREDIT	REQUIREMENTS	Measures provided on plan sheet:
		Install flashings integrated with a drainage plane.	

MATERIAL CONSERVATION & RESOURCE EFFICIENCY (Construction Waste Reduction, Disposal & Recycling)

5.408.1	Construction Waste Management	Recycle and/or salvage for reuse a minimum of 50% of the nonhazardous construction and demolition waste in accordance with Section 5.408.1.1, 5.408.1.2 or 5.408.1.3; or meet a local construction and demolition waste management ordinance, whichever is more stringent.	
5.408.1.1	Construction waste management plan	Where a local jurisdiction does not have a construction and demolition waste management ordinance that is more stringent, submit a construction waste management plan that complies with Items 1 through 4 of this section.	
5.408.1.2	Waste management company	Utilize a waste management company that can provide verifiable documentation that the percentage of construction and demolition waste material diverted from the landfill complies with this section. Exceptions to Sections 5.408.1.1 and 5.408.1.2: <ol style="list-style-type: none"> 1. Excavated soil and land-clearing debris 2. Alternate waste reduction methods developed by working with local agencies if diversion or recycle facilities capable of compliance with this item do not exist. 3. Demolition waste meeting local ordinance or calculated in consideration of local recycling facilities and markets 	
5.408.1.4	Documentation	Provide documentation of the waste management plan that meets the requirements listed in Sections 5.408.1.1 through 5.408.1.3, and the plan is accessible to the enforcement authority.	
5.408.2	Isolated jobsites	The enforcing agency may make exceptions to the requirements of this section when jobsites are located in areas beyond the haul boundaries of the diversion facility.	
5.408.3	Excavated soil and land clearing debris	100 percent of trees, stumps, rocks and associated vegetation and soils resulting primarily from land clearing shall be reused or recycled. Exception: Reuse, either on-or off-site, of vegetation or soil contaminated by disease or pest infestation.	

**MATERIAL CONSERVATION & RESOURCE EFFICIENCY
(Building Maintenance and Operation)**

5.410.1	Recycling by Occupants	Provide readily accessible areas that serve the entire building and are identified for the depositing, storage and collection of nonhazardous materials for recycling. 5.410.1.1 Additions. All additions conducted within a 12-month period under single or multiple permits, resulting in an increase of 30% or more in floor area, shall provide recycling areas on site. Exception: addition within a tenant space resulting in less than a 30% increase in the tenant space floor area.	
5.410.2	Commissioning	For new buildings 10,000 square feet and over, building commissioning for all building systems covered by Title 24, Part 6, process systems and renewable energy systems shall be included in the design and construction processes of the building project. Commissioning requirements shall include items listed in Section 5.410.2. Exceptions: <ol style="list-style-type: none"> 1. Dry storage warehouses of any size 2. Areas under 10,000 square feet used for offices or other conditioned accessory spaces within dry storage warehouses 3. Tenant improvements under 10,000 sqft as described in Section 303.1.1. 4. Commissioning requirements for energy systems covered by the 2013 <i>California Energy Code</i>. 	
5.410.2.1	Owner's Project Requirements (OPR)	Documented before the design phase of the project begins the OPR shall include items listed in Section 5.410.2.1.	
5.410.2.2	Basis of Design (BOD)	A written explanation of how the design of the building systems meets the OPR shall be completed at the design phase of the building project to cover the systems listed in Section 5.410.2.2.	
5.410.2.3	Commissioning Plan	A commissioning plan describing how the project will be commissioned shall include items listed in Section 5.410.2.3.	
5.410.2.4	Functional Performance Testing	Functional performance testing shall demonstrate the correct installation and operation of each component, system and system-to-system interface in accordance with the approved plans and specifications.	
5.410.2.5	Documentation and Training	A Systems manual and systems operations training are required. 5.410.2.5.1 Systems manual. The systems manual shall be delivered to the building owner or representative and facilities operator and shall include the items listed in Section 5.410.2.5.1. 5.410.2.5.2 Systems operations training. A program for training of the appropriate maintenance staff for each equipment	

SECTION	CREDIT	REQUIREMENTS	Measures provided on plan sheet:
		type and/or system shall be developed and shall include items listed in Section 5.410.2.5.2.	
5.410.2.6	Commissioning Report	A report of commissioning process activities undertaken through the design and construction phases of the building project shall be completed and provided to the owner or representative.	

5.410.4	Testing and Adjusting	<p>Testing and adjusting of systems shall be required for new buildings less than 10,000 square feet or new systems to serve an addition or alteration subject to Section 303.1.</p> <p>5.410.4.2 Systems. Develop a written plan of procedures for testing and adjusting systems. Systems to be included for testing and adjusting shall include, as applicable to the project, the systems listed in Section 5.410.4.2.</p> <p>5.410.4.3 Procedures. Perform testing and adjusting procedures in accordance with applicable standards on each system as determined by the enforcing agency.</p> <p>5.410.4.3.1 HVAC balancing. Before a new space-conditioning system serving a building or space is operated for normal use, balance in accordance with the procedures defined by national standards listed in Section 5.410.4.3.1 or as approved by the enforcing agency.</p> <p>5.410.4.4 Reporting. After completion of testing, adjusting and balancing, provide a final report of testing signed by the individual responsible for performing these services.</p> <p>5.410.4.5 Operation and maintenance manual. Provide the building owner with detailed operating and maintenance instructions and copies of guaranties/warranties for each system prior to final inspection.</p> <p>5.410.4.5.1 Inspection and reports. Include a copy of all inspection verifications and reports required by the enforcing agency.</p>	
ENVIRONMENTAL QUALITY (Fireplaces)			
5.503.1	General	Install only a direct-vent sealed-combustion gas or sealed wood-burning fireplace or a sealed woodstove or pellet stove, and refer to residential requirements in the <i>California Energy Code</i> , Title 24, Part 6, Subchapter 7, Section 150.	
5.503.1.1	Woodstoves	Woodstoves and pellet stoves shall comply with U.S. EPA Phase II emission limits where applicable.	
ENVIRONMENTAL QUALITY (Pollutant Control)			
5.504.1.3	Temporary Ventilation	If the HVAC system is used during construction, use return air filters with a Minimum Efficiency Reporting Value (MERV) of 8, based on ASHRAE 52.2-1999, or an average efficiency of 30% based on ASHRAE 52.1-1992. Replace all filters immediately prior to occupancy, or, if building is occupied during alteration, at the conclusion of construction.	
5.504.3	Covering of Duct Openings and Protection of Mechanical Equipment During Construction	At the time of rough installation and during storage on the construction site and until final startup of the heating, cooling and ventilating equipment, all duct and other related air distribution component openings shall be covered with tape, plastic, sheet metal or other methods acceptable to the enforcing agency to reduce the amount of dust, water and debris which may enter the system.	
5.504.4	Finish Material Pollutant Control	Finish materials shall comply with Sections 5.504.4.1 through 5.504.4.4.	
5.504.4.1	Adhesives, Sealants and Caulks	<p>Adhesives and sealants used on the project shall meet the requirements of the following standards.</p> <ol style="list-style-type: none"> Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits, as shown in Tables 5.504.4.1 and 5.504.4.2. Aerosol adhesives and smaller unit sizes of adhesives and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of <i>California Code of Regulations</i>, Title 17, commencing with Section 94507. 	
5.504.4.3	Paints and Coatings	<p>Architectural paints and coatings shall comply with Table 5.504.4.3 unless more stringent local limits apply.</p> <p>5.504.4.3.1 Aerosol paints and coatings. Aerosol paints and coatings shall meet the Product-Weighted MIR Limits for ROC in Section 94522(a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances (CCR, Title 17, Section 94520 et seq).</p> <p>5.504.4.3.2 Verification.</p>	

SECTION	CREDIT	REQUIREMENTS	Measures provided on plan sheet:
Verification of compliance with this section shall be provided at the request of the enforcing agency.			
5.504.4.4	Carpet Systems	<p>All carpet installed in the building interior shall meet the testing and product requirements of one of the standards listed in Section 5.504.4.4.</p> <p>5.504.4.4.1 Carpet cushion. All carpet cushion installed in the building interior shall meet the requirements of the Carpet and Rug Institute's Green Label program.</p> <p>5.504.4.4.2 Carpet adhesive. All carpet adhesive shall meet the requirements of Table 5.504.4.1.</p>	
5.504.4.5	Composite Wood Products	<p>Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in ARB's (Air Toxic Control Measure(ATCM) for Composite Wood (17 CCR 93120 et seq.). Those materials not exempted under the ACTM must meet the specified emission limits, as shown in the Table 5.504.4.5.</p> <p>5.504.4.5.3 Documentation. Verification of compliance with this section shall be provided as requested by the enforcing agency. Documentation shall include at least one of the following.</p> <ol style="list-style-type: none"> Product certifications and specifications Chain of custody certifications Product labeled and invoiced as meeting the Composite Wood Products regulation (see CCR, Title 17, Section 93120, et seq.) Exterior grade products marked as meeting the PS-1 or PS-2 standards of the Engineered Wood Association, the Australian AS/NZS 2269 or European 636 3S standards. Other methods acceptable to the enforcing agency. 	
5.504.4.6	Resilient Flooring Systems	<p>For 80% of floor area receiving resilient flooring, installed resilient flooring shall meet at least one of the following:</p> <ol style="list-style-type: none"> Certified under the Resilient Floor Covering Institute (RFCI) FloorScore program; Compliant with the VOC-emission limits and testing requirements specified in the California Department of Public Health's 2010 Standard Method for Testing and Evaluation Chambers, Version 1.1, February 2010; Compliant with the California Collaborative for High Performance Schools (CA-CHPS) Criteria Interpretation for EQ 2.2 dated July 2012 and listed in the CHPS High Performance product Database; or Compliant with CDPH criteria as certified under the Greenguard Children's & School Program. <p>5.504.4.6.1 Verification of compliance. Documentation shall be provided verifying that resilient flooring materials meet the pollutant emission limits.</p>	
5.504.5.3	Filters	<p>In mechanically ventilated buildings, provide regularly occupied areas of the building with air filtration media for outside and return air that provides at least a MERV of 8. MERV 8 filters shall be installed prior to occupancy, and recommendations for maintenance with filters of the same value shall be included in the operation and maintenance manual.</p> <p>Exceptions:</p> <ol style="list-style-type: none"> An ASHREA 10% to 15% efficiency filter shall be permitted for an HVAC unit meeting the 2013 <i>California Energy Code</i> having 60,000 Btu/h or less capacity per fan coil, if the energy use of the air delivery system is 0.4 W/cfm or less at design air flow. Existing mechanical equipment. <p>5.504.5.3.1 Labeling. Installed filters shall be clearly labeled by the manufacturer indicating the MERV rating.</p>	
5.504.7	Environmental Tobacco Smoke (ETS) Control	<p>Prohibit smoking within 25 feet of building entries, outdoor air intakes and operable windows where outdoor areas are provided for smoking and within the building as already prohibited by other laws or regulations; or as enforced by ordinances, regulations or policies of any city, county, city and county, California Community College, campus of the California State University or campus of the University of California, whichever are more stringent.</p>	
ENVIRONMENTAL QUALITY (Indoor Moisture Control)			
5.505.1	Indoor Moisture Control	Buildings shall meet or exceed the provisions of 2013 <i>California Building Code</i> , CCR, Title 24, Part 2, Sections 1203 (Ventilation) and Chapter 14 (Exterior Walls).	
ENVIRONMENTAL QUALITY (Indoor Air Quality)			
5.506.1	Outside Air Delivery	For mechanically or naturally ventilated spaces in buildings, meet the minimum requirements of Section 121 of the <i>California Energy Code</i> and Chapter 4 of CCR, Title 8 or the applicable local code, whichever is more stringent.	

SECTION	CREDIT	REQUIREMENTS	Measures provided on plan sheet:
5.506.2	Carbon Dioxide (CO ₂) Monitoring	For buildings or additions equipped with demand control ventilation, CO ₂ sensors and ventilation controls shall be specified and installed in accordance with the requirements of the 2013 <i>California Energy Code</i> , Section 121(c)(4).	
ENVIRONMENTAL QUALITY (Environmental Comfort)			
5.507.4	Acoustical Control	Employ building assemblies and components with STC values determined in accordance with ASTM E 90 and ASTM E 413 or OITC determined in accordance with ASTM E 1332, using either the prescriptive or performance method in Section 5.507.4.1 or 5.507.4.2.	
5.507.4.1	Prescriptive Method	<p>Wall and floor-ceiling assemblies exposed to the noise source making up the building or addition envelope or altered envelope shall meet a composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 in the following locations:</p> <ol style="list-style-type: none"> 1. Within the 65 CNEL noise contour of an airport. 2. Within the 65 CNEL or L_{dn} noise contour of a freeway or expressway, railroad, industrial source or fixed-guideway source as determined by the Noise Element of the General Plan. <p>5.507.4.1.1 Noise exposure where noise contours are not readily available. Buildings exposed to a noise level of 65 dB L_{eq}-1Hr during any hour of operation shall have building, addition, or alteration exterior wall and roof-ceiling assemblies exposed to the noise source meeting a composite STC rating of at least 45 (or OITC 35), with exterior windows of a minimum STC of 40 (or OITC 30).</p>	
5.507.4.2	Performance Method	<p>For buildings located as defined in Sections A5.507.4.1 or A5.507.4.1.1, wall and roof-ceiling assemblies making up the building or addition envelope or altered envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level (L_{eq}-1Hr) of 50 dBA in occupied areas during any hour of operation.</p> <p>5.507.4.2.1 Site features. Exterior features such as sound walls or earth berms may be utilized as appropriate to the building, addition or alteration project to mitigate sound migration to the interior.</p> <p>5.507.4.2.2 Documentation of compliance. An acoustical analysis documenting complying interior sound levels shall be prepared by personnel approved by the architect or engineer of record.</p> <p>5.507.4.3 Interior sound transmission. Wall and floor-ceiling assemblies separating tenant spaces and tenant spaces and public places shall have an STC of at least 40.</p>	
ENVIRONMENTAL QUALITY (Outdoor Air Quality)			
5.508.1	Ozone Depletion and Greenhouse Gas Reductions	<p>Installations of HVAC, refrigeration, and fire suppression equipment shall comply with Sections 5.508.1.1 and 5.508.1.2.</p> <p>5.508.1.1 Chlorofluorocarbons (CFCs). Install HVAC, refrigeration & fire suppression equipment that do not contain CFC.</p> <p>5.508.1.2 Halons. Install HVAC, refrigeration & fire suppression equipment that do not contain Halon.</p>	
5.508.2	Supermarket Refrigerant Leak Reduction When Applicable	<p>New commercial refrigeration systems shall comply with the provisions of this section when installed in retail food stores 8,000 sqft or more conditioned area, and that utilize either refrigerated display cases, or walk-in coolers or freezers connected to remote compressor units or condensing units. The leak reduction measures apply to refrigeration systems containing high-global-warming potential (high-GWP) refrigerants with a GWP of 150 or greater. New refrigeration systems include both new facility and the replacement of existing refrigeration systems in existing facilities.</p> <p>Exception: refrigeration systems containing low-global-warming potential (low-GWP) refrigerant with a GWP value less than 150 are not subject to this section. Low-GWP refrigerants are nonozone-depleting refrigerants that include ammonia, carbon dioxide (CO₂), and potentially other refrigerants.</p>	T.I. only
5.508.2.1	Refrigerant Piping	<p>Piping compliant with the <i>California Mechanical code</i> shall be installed to be accessible for leak protection and repairs. Piping runs using threaded pipe, copper tubing with an outside diameter (OD) less than ¼", flared tubing connection and short radius elbows shall not be used in refrigerant systems except as noted below.</p> <p>5.508.2.1.1 Treaded pipe. Threaded connections are permitted at the compressor rack.</p> <p>5.508.2.1.2 Copper pipe. Copper tubing with an OD less than ¼" may be used in systems with a refrigerant charge of 5 pounds or less.</p> <p>5.508.2.1.2.1 Anchorage. ¼" OD tubing shall be securely clamped to a rigid base to keep vibration levels below 8 mils.</p>	

SECTION	CREDIT	REQUIREMENTS	Measures provided on plan sheet:
		<p>5.508.2.1.3 Flared tubing connections. Double-flared tubing connections may be used for pressure controls, valve pilot lines and oil. Exception: Single-flared tubing connections may be used with a multiring seal coated with industrial sealant suitable for use with refrigerants and tightened in accordance with manufacturer's recommendations.</p> <p>5.508.2.1.4 Elbows. Short radius elbows are only permitted where space limitations prohibit use of long radius elbows.</p>	
5.508.2.2	Valves	<p>Valves and fittings shall comply with the <i>California Mechanical Code</i> and as follows:</p> <p>5.508.2.2.1 Pressure relief valves. For vessel containing high-GWP refrigerant, a rupture disc shall be installed between the outlet of the vessel and the inlet the pressure relief valve.</p> <p>5.508.2.2.1.1 Pressure detection. A pressure gauge, pressure transducer or other device shall be installed in the space between the rupture disc and the relief valve inlet to indicate a disc rupture or discharge of the relief valve.</p> <p>5.508.2.2.2 Access valves. Only Schrader access valves with a brass or steel body are permitted for use.</p> <p>5.508.2.2.2.1 Valves caps. For systems with a refrigerant charge of 5 pounds or more, valve caps shall be brass or steel and not plastic.</p> <p>5.508.2.2.2.2 Seal caps. If designed for it, the cap shall have a neoprene O-ring in place.</p> <p>5.508.2.2.2.2.1 Chain tethers. Chain tethers to fit over the stem are required for valves designed to have seal caps. Exceptions: Valves with seal caps that are not removed from the valve during stem operation.</p>	
5.508.2.3	Refrigerated Service Cases Where Applicable	<p>Refrigerated service cases holding food products containing vinegar and salt shall have evaporator coils of corrosion-resistant material, such as stainless steel; or be coated to prevent corrosion from these substances.</p> <p>5.508.2.3.1 Coil coating. Consideration shall be given to the heat transfer efficiency of coil coating to maximize energy efficiency.</p>	T.I.only
5.508.2.4	Refrigerant Receivers	<p>Refrigerant receivers with capacities greater than 200 pounds shall be fitted with a device that indicates the level of refrigerant in the receiver.</p>	
5.508.2.5	Pressure Testing	<p>The systems shall be pressure tested during installation prior to evacuation & charging.</p> <p>5.508.2.5.1 Minimum pressure. The system shall be charged with regulated dry nitrogen and appropriate tracer gas to bring system pressure up to 300 psig minimum.</p> <p>5.508.2.5.2 Leaks. Check the system for leaks, repair any leaks, and retest for pressure using the same gauge.</p> <p>5.508.2.5.3 Allowable pressure change. The system shall stand, unaltered, for 24 hours with no more than a +/- one pound pressure change from 300 psig, measured with the same gauge.</p>	
5.508.2.6	Evacuation	<p>The system shall be evacuated after pressure testing prior to charging.</p> <p>5.508.2.6.1 First vacuum. Pull a system vacuum down to at least 1000 microns (+/- 50 microns), and hold down for 30 minutes.</p> <p>5.508.2.6.2 Second vacuum. Pull a system vacuum to a minimum of 500 microns and hold for 30 minutes.</p> <p>5.508.2.6.3 Third vacuum. Pull a third vacuum down to a minimum of 300 microns, and hold for 24 hours with a maximum drift of 100 microns over a 24-hour period.</p>	

END OF DOCUMENT

03 11 00 – CONCRETE FORMING**PART 1: GENERAL**

1.1 SYSTEM DESCRIPTION

- A. Design, engineer, and construct formwork, shoring, and bracing to meet design and code requirements, so that resultant concrete conforms to required shapes, lines, and dimensions.

1.2 QUALITY ASSURANCE

- A. Construct and erect concrete formwork in accordance with ACI 301 and 347.

PART 2: PRODUCTS

2.1 WOOD FORM MATERIALS

- A. Plywood: Solid one side grade; sound, undamaged sheets with clean, true edges. Use only at concealed areas. Exposed concrete walls to be 1 x 6 rough sawn texture.
- B. Lumber: No. 2 or better grade; with grade stamp clearly visible.

2.2 FORMWORK ACCESSORIES

- A. Form Ties: Snap-off metal of adjustable length; cone type; 1 inch break back dimension; free of defects that will leave holes no larger than 1-1/4 inches diameter in concrete surface.
- B. Form Release Agent: Colorless material which will not stain concrete, absorb moisture or affect bond of subsequent surface finish, or impair natural bonding or color characteristics of coating intended for use on concrete.
- C. Fillets for Chamfered Corners and other justifications: Wood strips, sizes and configurations as detailed.
- D. Formed Construction Joints: Galvanized steel, tongue and groove type, knock-out holes spaced at 6 inches on center, with anchors.
- E. The conical formed pedestal below the Observatory floor down to the basement floor footing shall be permanently installed. Submit shop drawings for exposed Corten shaped steel with exposed ribs and stainless steel bolts and nuts.

PART 3: EXECUTION

3.1 EARTH FORMS

- A. Earth forms not permitted, except for footings where soil is conducive and approval is received from authorities having jurisdiction and structural engineer.

3.2 ERECTION

- A. Minimize form joints. Symmetrically align joints and make watertight to prevent leakage of mortar.
- B. Arrange and assemble formwork to permit stripping, so that concrete is not damaged during its removal.
- C. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.
- D. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.
- E. Provide chamfer strips on external corners of beams, and columns where they will be exposed to view after completion of construction.
- F. Do not displace or damage vapor barrier.
- G. Construct formwork to maintain tolerances in accordance with ACI 301.
- H. Construct form full depth of concrete to be placed.

3.3 APPLICATION OF FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

3.4 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for work embedded in or passing through concrete.
- B. Locate and set in place items which will be cast directly into concrete.
- C. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

- D. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.
- E. Install construction joint device in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

3.5 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 301.
- B. Camber slabs and beams as indicated in Drawings and in accordance with ACI 301.

3.6 FORM REMOVAL

- A. Do not remove forms, shoring and bracing until concrete has sufficient strength to support its own weight, and construction and design loads which may be imposed upon it.
- B. Do not damage concrete surfaces during form removal.
- C. Do not place wood forms which cannot be retrieved after concrete placement. Use steel forms.

END OF SECTION

03 20 00 – CONCRETE REINFORCEMENT**PART 1: GENERAL**

1.1 QUALITY ASSURANCE

- A. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice, Documents 63 and 65.
- B. Conform to ACI 301 and 318.

PART 2: PRODUCTS

1.2 MATERIALS

- A. Reinforcing Steel: ASTM A 615, grade billet-steel deformed bars, uncoated, 60 KSI yield grade; ASTM A 706, grade 40 weldable for bars welded to steel members.
- B. Welded Steel Wire Fabric: ANSI/ASTM A 185 plain type; in flat sheets; uncoated finish.
- C. Contractor's Option: Glass fiber reinforcement, ASTM C 948 collated, fibrillated, polypropylene fibers.

1. Acceptable Products:

- a. Forta CR by Forta Corporation.
- b. "Fibermesh" by Fibermesh, Inc.

1.3 ACCESSORY MATERIALS

- A. Tie Wire: Minimum 16 gage annealed type.
- B. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for strength and support of reinforcement during installation and placement of concrete including load bearing pad on bottom to prevent vapor barrier puncture.

1.4 FABRICATION

- A. Fabricate in accordance with ACI SP-66, providing concrete cover specified in drawings.
- B. Locate reinforcing splices not indicated on Drawings at points of minimum stress. Indicate location of splices on shop drawings.
- C. Weld reinforcing bars in accordance with ANSI/AWS D1.4.
- D. Provide sufficient lap of splicing of reinforcement, where required, to permit transfer of stress in accordance with requirements of this specification. Splice wall vertical reinforcement at location of horizontal construction joints.
- E. Unless otherwise noted on the drawings to be more, lap reinforcement 36 bar diameters (class "A" lap) at splices or have dowels of same bar section and spacing as the bars to be spliced. Lap bars at least 36 diameters (class "A" lap) at corners and at abrupt changes in direction of walls. Stagger splices in adjacent bars.

PART 2: EXECUTION

1.5 PREPARATION

- A. Before placing concrete, clean reinforcement of foreign particles or coatings.

1.6 PLACING

- A. Place reinforcement in accordance with CRSI "Placing Reinforcing Bars" and ACI 318, with provisions of ACI 318 governing.
- B. Move bars as necessary to avoid interference with other reinforcing steel, conduits, or embedded items.
- C. If bars are moved more than one bar diameter or enough to exceed tolerances, submit resulting arrangement of bars to Owner's Representative for review.
- D. Place, support, and secure reinforcement against displacement. Do not deviate from alignment or measurement. Place in accordance with approved shop drawings and CRSI recommendations. Do not heat, cut or bend bars without Owner's Representative's approval.
- E. Do not displace or damage vapor barrier.
- F. Refer to Section 03 30 00 for minimum coverage of concrete unless noted otherwise on the Drawings.
- G. Place reinforcement, at time of concrete placing, free of mud, oil, or other materials that adversely affect or reduce bond.

- H. Reinforcement with Rust, Mill Scale, or Both: Considered satisfactory, provided minimum dimensions, including height of deformation, and weight of hand-wire-brushed test specimen are not less than ASTM A 615 requirements.
- I. Support reinforcement and fasten together to prevent displacement by construction loads of placing concrete. Use No. 16 gage black annealed wire at joints and crosses to accurately position reinforcing in place.
- J. Over formwork, use metal or plastic bar chairs and spacers to support reinforcement.
- K. Where concrete surface will be exposed to weather in finished structure, use non-corrosive or corrosion protected accessories within 1/2 inch of concrete surface.
- L. Bars having splices not shown on shop drawings will be subject to rejection.
- M. Do not bend reinforcement after being embedded in hardened concrete.
- N. Do not allow bars to be in contact with dissimilar materials.

END OF SECTION

03 30 00 – CAST-IN-PLACE CONCRETE**PART 1: GENERAL**

1.1 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301, 304, 305, 306, 309, and 318.
- B. Obtain materials from same source throughout the Work.

1.2 REGULATORY REQUIREMENTS

- A. Conform to applicable building code.

1.3 COORDINATION

- A. Notify responsible trades of schedules of concrete pours so as to allow adequate time for installation of their work.
- B. Obtain anchor bolts and other miscellaneous steel items to be cast into concrete from material supplier.
- C. Coordinate size and location of mechanical equipment concrete pads with applicable trades.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Mix and deliver concrete to project ready-mixed in accordance with ASTM C 94.
- B. Schedule delivery so that continuity of any pour will not be interrupted for over 15 minutes.
- C. Place concrete on site within 90 minutes after proportioning materials at batch plant.

PART 2: PRODUCTS

1.5 CONCRETE MATERIALS

- A. Cement: ASTM C 150, Normal - Type II; air entrained where exposed to the freeze-thaw cycle; gray color.
- B. Fine Aggregate: ASTM C 33 clean, hard, durable, natural sand free from silt, loam or clay.
- C. Coarse Aggregate: ASTM C 33, hard, durable, uncoated, crushed limestone or other approved aggregate.
- D. Water: Clean and not detrimental to concrete.

1.6 ADMIXTURES

- A. Air Entrainment: ASTM C 260
 - 1. **Acceptable Manufacturers: Subject to compliance with requirements herein, provide products from one of the following:**
 - a. W.R. Grace.
 - b. Master Builders.
 - c. Sika.
- B. Chemical Admixtures: ASTM C 494. Depending upon weather conditions at time of placing, cement-dispersing agent may be supplemented by a set- retarding or set-accelerating agent to improve control of setting and, in the case of hot weather, to minimize surface checking. Introduce admixtures in quantities and according to methods recommended by manufacturers of materials approved for use. Introduce admixtures only after receiving written approval from testing laboratory and Structural Engineer.

1.7 ACCESSORIES

- A. Sheet Vapor Barrier:
 - 1. **Type: 15 mil film meeting requirements of ASTM E 1745, Class A and B.**
 - 2. **Water Vapor Transmittance: Maximum 0.006 grams per square foot per hour.**
 - 3. **Tensile Strength: Minimum 54.2 pounds at 1139 percent strain/MD per ASTM D 638.**
 - 4. **Tear Resistance: 7.40 pounds per foot MD per ASTM D 1004.**
 - 5. **Acceptable Products:**
 - a. Stego Wrap Vapor Barrier by Stego Industries, llc, San Juan Capistrano, CA.
 - b. Comparable products by Reef Industries, Raven Industries, and WR Meadows.
 - 6. **Accessories: Rubber based pressure sensitive adhesive polyethylene tape.**
 - a. Acceptable Product: Stego Wrap Red Polyethylene Tape.

1.8 CONCRETE MIX (STANDARD TYPE)

- A. Mix concrete in accordance with ASTM C 94, Alternative No. 2, or ACI 304.

- B. Deliver concrete in accordance with ASTM C 94.
- C. Select proportions for normal weight concrete in accordance with ACI 301 Method 1. Mix not less than one minute after materials are in mixer.
- D. Do not transport or use concrete after the following time has expired from time of initial mixing:
 1. **90 minutes when ambient temperatures are below 80 degrees F.**
 2. **75 minutes when ambient temperatures are between 80 and 90 degrees F.**
 3. **60 minutes when ambient temperatures are over 90 degrees F. Verify supplier of transit-mixed concrete has a plant of sufficient capacity, and adequate transportation facilities to assure continuous delivery at required rate. Frequency of deliveries to project site shall be such as to provide for continuous concrete placement throughout any one pour.**
- E. Use of calcium chloride is strictly prohibited.

1.9 CONCRETE MIX (PERVIOUS DESIGN – 20% voids)

- A. Refer to Section 36 20 03 for additional specifications and information. Alternative to pervious concrete, section 36 20 02 is an approved option utilizing Asphaltic Pavement. The contractor shall investigate each alternate and select materials and required installation most economically appropriate for the project. Submit design based on findings to the WQMP and civil engineer for approval.
- B. Mix concrete in accordance with ACPA (standard duty design factors)
 1. **K = 230 psi /inch (modified k value for 6 inches of aggregate – 40% voids)**
 2. **Modulus of rupture of 366 psi**
 3. **ADTT = 1**
 4. **Traffic category of A (5.5 inches of pervious concrete)**
- C. Jointing and Sealing: Designed in accordance with ACI 330R-08 and ACI 522R-10
 1. **Pervious concrete maximum joint spacing is 20 feet in either direction**
 - a. Contraction joint is un-doweled
 - b. Depth to be ¼ the concrete thickness minimum
 2. **Length to width ratio not exceeding 1.25**
 3. **Place at every other stall bay**
 4. **Timing of joint cuts shall be provided in accordance with ACI 522R-10.**
 5. **Neither contraction nor construction joints are required to be sealed.**
- D. Placement:
 1. **Avoid sloped surface whenever possible**
 2. **Flat design allows the subgrade to absorb as much water as possible.**
 3. **Impervious barriers are included at direction of horizontal flow.**
 4. **Comply with ACI Section 522R-10**

PART 2: EXECUTION

1.10 EXAMINATION

- A. Verify anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not cause hardship in placing concrete.
- B. Correct unsatisfactory work prior to placing concrete.
- C. Remove rubbish from formwork immediately prior to placing concrete.
- D. Remove ice and excess water from excavations and formwork.
- E. All installations of pervious concrete shall meet one of the following criteria for the minimum Certification for each placement crew and shall submit verification of NRMCA Pervious Concrete to Certification prior to scheduling concrete pour.
 1. **Employ no less than one (1) NRMCA Certified Craftsman who must be onsite, actively guiding and working with each placement crew during all placement**
 2. **The pervious concrete subcontractor shall employ no less than three (3) NRMCA Certified pervious Concrete Installers who must be onsite, actively guiding and working with pervious concrete for projects.**
 3. **The pervious concrete subcontractor shall employ no less than three (3) NRMCA Pervious Concrete technicians and one (1) pervious Installer who shall be onsite, actively guiding and working with each placement crew during all pervious concrete placement.**

1.11 PREPARATION

- A. Install vapor barrier under interior slabs-on-fill and over sand leveling bed, if present. Lap joints minimum 12 inches and seal with special tape of same permeance as vapor barrier. Do not disturb or damage vapor barrier while placing concrete. Repair damaged vapor barrier.

1.12 PLACING CONCRETE

- A. Notify testing laboratory a minimum of 24 hours prior to commencement of concrete operations.
- B. Place concrete in accordance with ACI 301 and as specified below.
1. **Unless protection is provided, do not place concrete in rain, sleet, or snow.**
 2. **Regulate rate of placement so concrete remains plastic and flows into position.**
 3. **Deposit concrete continuously until panel or section is completed. Place as near as possible to its final location; do not re-handle.**
 4. **Consolidation**
 - a. Comply with requirements of ACI 309.
 - b. Use mechanical vibrating equipment for consolidation.
 - c. Do not use vibrators to transport concrete in forms.
 - d. Thoroughly consolidate concrete and work around reinforcement, embedded items and into corners of forms. Thoroughly consolidate layers of concrete with previous layers.
 5. **Cold Weather Placement: Do not place concrete when temperature is below 40 degrees F unless cold weather concrete procedures are followed as specified in ACI 306. Calcium chloride shall not be used.**
 6. **Hot Weather Placement: Exercise special care to prevent high temperature in fresh concrete during hot weather in accordance with ACI 305. Use water reducing set-retarding admixtures in such quantities as especially recommended by manufacturer to assure that concrete remains workable and lift lines will not be visible.**
- C. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
- D. Unless noted otherwise on the Drawings, maintain concrete cover around reinforcing in accordance with ACI 318.
- E. Place concrete continuously between predetermined construction and control joints.
- F. Place floor slabs on fill in pattern indicated on Drawings.
- G. Separate exterior slabs on fill from vertical surfaces with joint filler. Extend joint filler from bottom of slab to within 1/4 inch of finished slab surface.
- H. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Owner's Representative upon discovery.
- I. Maintain record of concrete placement. Record date, location, quantity, air temperature and test samples taken.

1.13 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed formed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- B. Curing Methods: Perform curing of formed concrete by moist curing, or by moisture-retaining cover curing, as herein specified.
- C. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by moisture cover curing method.
- D. Curing Unformed Surfaces: Cure unformed surfaces, including slabs and other flat surfaces, in accordance with Section 03355.

1.14 PATCHING CONCRETE SURFACES

- A. It is the intent of these Specifications to provide for grade beams of such quality as to require a minimum of pointing.
- B. Exercise care in forming, mixing and placing of concrete to ensure reasonably uniform dense surfaces, free from blemishes, voids, or honeycombs.
- C. Repair and patch defective areas with cement mortar and bonding agent mixture immediately after removal of forms, when acceptable to Owner's Representative.
1. **Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean,**

dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar before bonding compound has dried.

1.15 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01 45 23.
- B. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.
- C. Cast-in-Place Concrete
 - 1. **Test Cylinders: Make at least one test of each day's pouring or each 50 cubic yards, whichever comes first, on each different portion or section of the work. Mold and cure specimens in accordance with ASTM C 31, and test in accordance with ASTM C 39. Test cylinders shall be made and tested by the laboratory in accordance with ASTM C 172. Footings, walls, and floor systems constitute different sections. Each test shall consist of 5 specimens, 2 of which shall be broken at 7 days, 2 at 28 days and one held in reserve. Determine temperature and air content for each set of test cylinders in accordance with ASTM C 231.**
 - 2. **Field Quality Control**
 - a. Determine slump for each strength test and whenever consistency of concrete appears to vary, in accordance with ASTM C 143.
 - b. Monitor addition of water to concrete and length of time concrete is allowed to remain in truck.
 - c. Certify delivery tickets indicating class of concrete, amount of water added during initial batching, and time initial batching occurred.
 - d. Monitor work being performed in accordance with ACI recommendations as a standard of quality.

1.16 PROTECTION

- A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, rain or running water and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

1.17 SCHEDULE OF MIXES

- A. Refer to Drawings.

END OF SECTION

03 35 12 – Concrete Floor Finishing & Curing**PART 1: GENERAL**

- 1.1 QUALITY ASSURANCE
 - A. Conform to ACI 301.
- 1.2 ENVIRONMENTAL REQUIREMENTS
 - A. Maintain ambient temperature during curing period above 70 degrees F for 3 days or above 50 degrees F for 5 days.
 - B. Protect from rain or running water.

PART 2: PRODUCTS

- 2.1 MANUFACTURERS
 - A. Acceptable Manufacturers: Subject to compliance with requirements indicated, provide products of one of the following:
 - 1. **Sonneborn Building Products**
 - 2. **L & M Construction Chemicals**
 - 3. **Secure, Inc.**
 - 4. **Dayton Superior**
 - 5. **Burke**
 - B. Substitutions: Refer to Section 01 60 00 for product requirements.
- 2.2 MATERIALS
 - A. Sodium Silicate Compounds: Zero-VOC water-based sodium silicate compound in solution. Clear. Non-membrane forming. Compounds in suspension not permitted.
 - 1. **Compatible with subsequent coatings and toppings without stripping.**
 - 2. **Acceptable Products:**
 - a. Sinak S-102, Sinak Corp., San Diego, CA
 - b. L&M Cure, L&M Construction Chemicals, Omaha, NE.
 - c. Eucosil, Euclid Chemical Company, Cleveland, OH.
 - d. Ashford Formula, Crecrete Distribution Inc.
 - a. Accepted Substitute in accordance with Section 01600.

PART 3: EXECUTION

- 3.1 INSPECTION
 - A. Verify floor surfaces are acceptable for application of this work.
 - B. Ensure floor surfaces are depressed to accommodate finish materials.
 - C. Beginning of installation means acceptance of surfaces.
- 3.2 FLOOR FINISHING
 - A. Finish concrete floor surfaces in accordance with ACI 301.
 - B. Uniformly spread, screed, and float concrete. Do not use grate tampers or mesh rollers. Do not spread concrete by vibration.
 - C. Manually float surfaces which will receive ceramic tile with full bed setting system.
 - D. Steel trowel surfaces to receive carpeting, resilient flooring, seamless flooring, thin set ceramic tile, and surfaces to be left exposed.
 - E. Apply hardener/sealer in accordance with manufacturer's instructions on scheduled floor surfaces.
- 3.3 TOLERANCES.
 - A. Maintain surface flatness to ACI 302 of Ff30 and levelness of F125 for floors to receive carpet, resilient surfaces, thin set tile, and surfaces to be left exposed; maintain flatness to Ff15 and levelness to F113 for recessed sub-slabs. Test flatness and levelness in accordance with ASTM E 1155.
 - B. In areas of floor drains, maintain floor level at walls and slope surface uniformly to drains at 1/8 to 1/4 inch per foot.

3.4 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.
- C. Curing Methods: Perform curing of concrete by curing and sealing compound, or by moisture-retaining cover curing, and by combinations thereof, as herein specified.
- 1. Provide moisture curing by the following Method 1:**
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Use continuous water-fog spray.
 - 2. Provide moisture-cover curing by the following Method 2:**
 - a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3. Provide curing compound to exposed interior slabs and to exterior slabs, walks, and curbs as follows:**
 - a. Apply specified curing compound to concrete slabs as soon as final finishing operations are complete, within 2 hours and after surface water sheen has disappeared. Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - b. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.
 - c. Apply in accordance with manufacturer's instructions and ACI 301.
 - d. Do not apply curing compound on surfaces to receive applied coatings and finishes. Use other methods specified herein.

END OF SECTION

03 35 19 – COLORED CONCRETE FINISHING**1 PART ONE – GENERAL**

Use colored concrete finish at exterior slabs integral with the improvements inside the gates.

1.1 PRODUCT NAME

SGS Integral Colors for Ready Mix Concrete

1.2 MANUFACTURER

Solomon Colors

1.3 PRODUCT DESCRIPTION

A. Basic Use: SGS Integral Colors for Ready Mix Concrete are pure mineral pigments designed for use in cementations slump applications. These colors are commonly used in the manufacturing of ready mix concrete, architectural concrete stamping, driveways, sidewalks, patios, grout, vertical pre-cast and poured-in-place concrete construction.

B. SGS Color-Flo Liquid Colors are pre-dispersed iron oxide pigments containing high pigment solid in an aqueous base liquid. The use of SGS Color-Flo Liquid Colors provides an easy handling, dust free environment for integral coloring of ready mix concrete and other cementation products. SGS Color-Flo Liquids are thixotropic in nature and ideally suited for use with automatic dispensing systems.

1.4 FINISHES

A. Finish texture and appearance is a function of the concrete mix and finishing technique. Use a clear, non-yellowing, breathable UV-stable acrylic cure and seal after 24 hours. (In locales where high heat and low humidity conditions exist, a non-staining evaporation control and/or sealers may need to be applied sooner. For dry shake applications, the evaporation control should be applied after the color has been floated into the surface).

B. After the slab is completely dry, apply a clear non-yellowing acrylic sealer as the final step. A low percent of solids, generally between 12% – 14% is recommended to ensure satisfactory penetration of the sealer. If a higher “gloss” is desired, wait until the first coat dries before applying a second coat.

1.5 LIMITATIONS

A. To avoid strength reductions, do not use more colorant that 10% of the total weight of cement used. Maximum color tint value is normally reached at 7% - 8% proportion. Optimum range for color additives is about 2% - 7% pigment loading based on total cementitious material weight. Pigment loading less than 1% (in gray cement) can cause irregular coloring washed out appearance.

PART TWO – INSTALLATION**2.1 PREPARATOR WORK**

A. Handle and store product according to Solomon recommendations. Mix should conform to ASTM C94, Portland cement to ASTM C150 and coarse and fine aggregates to ASTM C33. Utilize the proper mix design to achieve desired strength. Weigh or measure water, color pigments, aggregates and other additives to ensure batch uniformity.

2.2 METHODS

A. Integral Coloring Method: For best results use 2 – 7 lbs (.91 – 3.18kg) of pigment per 100 lbs (45.4kg) of cement. Always add ingredients in the same order for each batch. Make sure the mixer is clean and there is no washout water left in the mixer. Load mixer in customary manner with water, coarse and fine aggregates (ASTM C33-97) and Portland cement (ASTM C150-97a). The water to cement ratio should be maintained at a level not to exceed a 3 ½” to 4” slump. If the job requires a higher slump for proper placement, a super plasticizer should be used. SGS Integral Colors For Ready Mix Concrete can be added at the plant or job site. Mix for a minimum of 15 minutes (10 minutes at high speed) before placement. The source, brand and color of sand, gravel and cement should be consistent.

2.3 PRECAUTIONS

A. Color pigment weight should not exceed 10% of the weight of cement.

B. **DO NOT** load the mixer beyond the recommended capacity. Overloading will reduce mixing efficiency.

C. Mixer should be loaded to a minimum of 40% capacity to insure good color dispersion.

- D. Use of “fly ash” in colored ready mix in **NOT** recommended due to its inconsistent color.
- E. Water to cement ratio should not exceed .50 (weight of water divided by weight of cement).
- F. Adding water to ready mix concrete during a pour to allow for the placement of concrete in stages, should be kept to a minimum.
- G. Over-finishing should be avoided to keep; a. *bleed water to a minimum and*; b. *to protect against “brining” the surface.*
- H. Allow excess surface water to evaporate. Above normal water to cement ratios may cause spalling.
- I. Initial floating should be discontinued as soon as the surface becomes wet. Floating may be resumed after the surface water disappears.
- J. Avoid the use of calcium chloride or additives containing chlorides. These products can cause discoloration in the form of light and dark areas in the finished product.
- K. When admixtures are a part of the job’s mix design, their use must be employed equally throughout the job to ensure consistent colors.
- L. Never add color to a concrete mixer as the first ingredient.
- M. **DO NOT** “fog with water or cover surface during the initial curing process for at least 24 hours.
- N. Make sure the depth of a “broom finish” remains the same throughout the entire job. **NO NOT** wet the broom between strokes.
- O. Be sure the slab is clean and dry before applying a sealer.
- P. **DO NOT** “hard” trowel a colored surface. Hard troweling can leave dark blotches and uneven coloring on the surface of the slab.
- Q. Always fluff colored release before using by shaking and turning the pail upside down several times. Setting may occur during shipping.
- R. Store Color-Flo liquids away from direct sunlight to avoid excessive moisture loss.
- S. Protect Color-Flo liquids from freezing.

PART THREE – MAINTENANCE

A. The primary cause of maintenance work for colored concrete is the formation of efflorescence. In the event cleaning is required to remove efflorescence, the cleaning operation should be undertaken after the colored concrete has sufficiently cured, generally 7 – 28 days after installation depending upon daily curing temperatures, atmospheric humidity and other seasonal weather conditions. Avoid using hydrochloric (muriatic) acid. Use commercially prepared “proprietary concrete cleaner” following the directions for the weakest solution recommended by manufacturer.

*****END OF SECTION*****

04 05 00 – MASONRY WORK**PART 1 GENERAL**

1.1 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and protect products under provisions of Section 01600.
- B. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.2 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: IMIAC - Recommended Practices and Guide Specifications for Cold Weather Masonry Construction. When air temperature is below 40 degrees F., provide adequate equipment for heating the mortar and grout materials. Temperatures of separate materials, including water, shall not exceed 140 degrees F., when placed in the mixer. Mortar and grout shall have a temperature between 50 degrees F., and 90 degrees F. while being used.
- B. Warm Weather Requirements: Wet mortarboard before loading and cover mortar to retard drying when being used. Use all mortar and grout within one hour of initial mixing and use no mortar or grout after it has begun to set up or after it has become harsh or non-plastic.
- C. Mortar and grout shall be tested in the field as specified below. Laboratory shall make, cure and break test specimens.
- D. Specimens for grout shall be made as outlined by UBC Standard No. 24 – 23 or by AMG.
- E. Handle specimens for mortar in accordance with procedures outlined by AMG – 104.
- F. Number of test will be determined by Architect based on total time for construction of masonry with no less than 2 tests per week and on less than 2 tests for each level of masonry construction (foundation to roof or floor).

PART 2 PRODUCTS

2.1 MATERIALS

- A. Portland Cement: ASTM C 150, Type II, low alkali Portland cement gray color all from one source (manufacturer).
- B. Mortar Aggregate: ASTM D448, coarse aggregate size and No. 8. ASTM C 144, standard masonry type.
- C. Sand for grout shall conform to ASTM C404, fine aggregate, size No.1.
- D. Admixture for grout shall be Sika Grout Aid as manufactured by Sika Chemical. All grout used for reinforced masonry shall contain admixture in strict accordance with manufacturer's printed instruction.
- E. Hydrated Lime: ASTM C 207, Type S.
- F. Quicklime: ASTM C 5, non-hydraulic type.
- G. Grout Aggregate: ASTM C 33, pea gravel uniformly sorted from 3/8 inch to ½ inch.
- H. Water: Clean and potable.
- I. Mortar coloring material shall consist of lime proof inorganic compounds in the proportions recommended by the manufacturer, and in no case exceeding 15% of the weight of the cement. At all exposed locations color mortar to match the color of the masonry units.

2.2 MORTAR MIXES

- A. Mortar for Non-load Bearing Walls and Partitions: ASTM C 270, Type N using the Property Method to achieve 750 psi strength.
- B. Mortar for Reinforced Masonry: ASTM C 270, Type S using the Property Method to achieve a minimum compressive strength of 2000 PSI at 28 days.
- C. Mortar for concrete unit masonry shall be freshly prepared and uniformly mixed in ratio one part Portland cement, ½ part lime. 3 – 4 parts sand, and shall conform to ASTM C270, Type S.
- D. Fine grout shall be composed of one part Portland cement, to which may be added 1/10 part hydrated lime or lime putty, and 2 ¼ to 3 parts sand, and not more than 2 parts aggregate (grave). This grout may only be used in grout spaces in brick masonry 2" or more in horizontal dimension and in grout spaces in filled cell construction 4" or more in both horizontal dimensions.

2.3 MORTAR MIXING

- A. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C 270 and C 780. Mix grout after all ingredients are added to mixer for a period of at least 5 minutes or until a thoroughly uniform mix has been obtained, whichever period is longer. Grout shall have as high a water content as is consistent with placing and workability without segregation.

- B. Provide uniformity of mix.
- C. Do not use anti-freeze compounds to lower the freezing point of mortar.
- D. If water is lost by evaporation, re-temper only within 2 hours of mixing.
- E. Use mortar within two hours after mixing at temperatures of 80 degrees F, or 2-1/2 hours at temperatures under 50 degrees F.

2.4 GROUT MIXES

- A. Bond Beams: 2500 psi strength at 28 days; 9-1/2 inches slump; premixed type in accordance with ASTM C 94.

2.5 GROUT MIXING

- A. Mix concrete in accordance with ASTM C 94.
- B. Add admixtures in accordance with manufacturer's instructions. Provide uniformity of mix.
- C. Do not use anti-freeze compounds to lower the freezing point of grout.

2.6 MANUFACTURERS - REINFORCEMENT, ANCHORAGES, AND ACCESSORIES

- A. Acceptable Manufacturers: Subject to compliance with requirements herein, provide products from one of the following:
 - 1. **Dur-O-Wal, Inc. Arlington Heights, IL.**
 - 2. **Heckmann Building Products, Inc., Chicago, IL.**
 - 3. **Hohmann & Barnard, Inc., Hauppauge, NY.**
- B. Substitutions: Submit in accordance with Section 01600.

2.7 REINFORCEMENT AND ANCHORAGES

- A. Horizontal Joint Reinforcing:
 - 1. **Type: Standard truss design, fabricated from ASTM A 82 cold-drawn steel wire.**
 - 2. **Side Rods: Two or more continuous 9 gage deformed side rods butt welded in same plane to continuous diagonal 9 gage plain cross rod at 16 inches on centers maximum.**
 - 3. **Size: Standard length 10 to 20 feet; side rods spaced approximately 2 inches less than width of partition or wall in which placed.**
 - 4. **Finish: Exterior walls; ASTM A 153, Class B-2, minimum 1.5 ounce per square foot zinc coating) hot-dip galvanized.**
 - 5. **Provide prefabricated tee and corner units.**
 - 6. **Acceptable product: Dur-O-Wal Truss by Dur-O-Wal.**
- B. Reinforcing Bars: Deformed steel, ASTM A 615, Grade 60, unless noted otherwise on structural drawings.
- C. Veneer Wall Ties: 7/8 inch wide by 7inches long minimum (masonry ledge depth plus 4 inches), corrugated sheet steel, 20 gage, and galvanized finish.
 - 1. **Acceptable Product: Model No. D/A CWT by Dur-O-Wal**
- D. Expansion Joint Fillers:
 - 1. **Type: Closed cell neoprene complying with ASTM D 1056, Class RE41.**
 - 2. **Compatible with sealant.**
 - 3. **Self adhering on one side; 50 percent minimum compressibility.**
 - 4. **Size: Thickness to suit joint size; depth to allow sealant application.**
 - 5. **Locations: Vertical expansion joints, horizontal joints at head of masonry terminating below shelf angles, beams, or slabs; other locations as detailed.**
 - 6. **Acceptable Products: D/A 2010 and 2015 by Dur-O-Wal.**

PART 3 EXECUTION

3.1 EXAMINATION

- A. Request inspection of spaces to be grouted.

3.2 INSTALLATION

- A. Install mortar and grout to requirements of the specific masonry Sections.
- B. Work grout into masonry cores and cavities to eliminate voids.
- C. Do not displace reinforcement while placing grout.
- D. Remove grout spaces of excess mortar.

END OF SECTION

04 20 00 – UNIT MASONRY**PART 1: GENERAL**

1.1 SUBMITTALS

- A. Submit samples under provisions of Section 01 32 19.
- B. Submit 4 samples of decorative face brick units to illustrate color texture and extremes of color range.

1.2 QUALITY ASSURANCE

- A. Expansion Joints: Provide expansion joints as shown on the Drawings or if not shown, install at frequency and in accordance with details as recommended by the N.C.M.A. or B.I.A. Confirm locations and frequency with Owner's Representative before beginning work.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. In hot weather, above 99 degrees F with less than 50 percent relative humidity, protect masonry construction from direct exposure to sun and wind.
- B. Cold Weather Requirements: IMIAC - Recommended Practices and Specifications for Cold Weather Masonry Construction.

PART 2: PRODUCTS

2.1 CONCRETE MASONRY UNIT MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements indicated, provide products of one of the following:
 - 1. **Trinity Industries.**
 - 2. **Featherlite.**
 - 3. **TXI.**
- B. Substitutions: Under provisions of Section 01600.

2.2 CONCRETE MASONRY UNITS

- A. Hollow Units: ASTM C 90, Grade N, Type I; light weight.
- B. Solid Units: ASTM C 145, Grade N, Type I; light weight.
- C. Concrete Brick: ASTM C 55, Grade N, Type I; normal weight.
- D. Sizes: Modular sized to widths as indicated on Drawings by 8 inch high by 16 inch long; provide special units for 90 degree corners, bond beams, 45 degree corners, lintels.

2.3 BRICK MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements herein, provide products from one of the following:
 - 1. **Acme Brick.**
 - 2. **U.S. Brick.**
 - 3. **Elgin-Butler.**
 - 4. **Boral Henderson Clay Products.**
- B. Substitutions: Under provisions of Section 01600.

2.4 BRICK UNITS

- A. Face Brick: ASTM C 216, Type FBS, Grade SW; sized as indicated on Drawings.
 - 1. **Acceptable Product: Refer to finish legend on Drawings.**
- B. Special Shapes: Of same brick type as above, shaped to profile indicated including solids, 45 degree corners, 45 degree soldiers; surface texture on face and ends.

2.5 MANUFACTURERS - REINFORCEMENT, ANCHORAGES, AND ACCESSORIES

- A. Acceptable Manufacturers: Subject to compliance with requirements herein, provide products from one of the following:
 - 1. **Dur-O-Wal, Inc. Arlington Heights, IL.**
 - 2. **Heckmann Building Products, Inc., Chicago, IL.**
 - 3. **Hohmann & Barnard, Inc., Hauppauge, NY.**
- B. Substitutions: Submit in accordance with Section 01 60 00.

2.6 MASONRY FLASHINGS

- A. Rubberized Asphalt: 40 mil thick, laminated composition of rubberized asphalt and cross laminated polyethylene.

1. Acceptable Products:

- a. Perm-A-Barrier Wall Flashing by W.R. Grace Construction Products Division.
b. 400 Through Wall Flashing by Polyguard.

2.7 ACCESSORIES

- A. Control Joints: Preformed rubber material. Width slightly less than wall thickness to allow for sealant material.
B. Joint Sealant: Refer to Section 07 92 00.
C. Weep Holes: Open head joints.
D. Cleaner: Verify with masonry manufacturer that cleaner specified is acceptable.

1. Acceptable Products subject to manufacturer's approval:

- a. "Deox" Chemical Cleaner by National Chemsearch Corp.
b. "Sure Klean" by Process Solvent Co., Inc.

- E. Cavity Drainage Material: 1 inch thick, free-draining mesh; made from polyethylene strands and shaped to avoid being clogged by mortar droppings.

1. Acceptable Products:

- a. Mortar Net; Mortar Net USA, Ltd.
b. Mortar Stop; Polytite Manufacturing Corp.

PART 3: EXECUTION

3.1 PREPARATION

- A. Establish lines, levels, and coursing. Protect from disturbance.
B. Provide temporary bracing during erection of masonry work. Maintain in place until building structure provides permanent bracing.
C. Wet clay masonry units prior to laying if required to reduce excessive absorption of mortar moisture by the unit. Do not wet concrete masonry units.

3.2 COURSING

- A. Place masonry to lines and levels indicated.
B. Maintain masonry joints to uniform width of 3/8 inches. Make vertical and horizontal joints equal, of uniform thickness, tightly tucked.
C. Lay concrete masonry units in running bond. Course one block unit and one mortar joint to equal 8 inches. Form concave mortar joints on exposed work and flush joints on work to receive subsequent wall coating.
D. Lay clay brick and concrete brick in running bond. Form concave mortar joints.

3.3 PLACING AND BONDING

- A. Lay masonry in full bed of mortar, properly jointed with other work. Buttering corners of joints and deep or excessive furrowing of mortar joints are not permitted.
B. Fully bond intersections, and external and internal corners.
C. Do not shift or tap masonry units after mortar has taken initial set. Where adjustment must be made, remove mortar and replace.
D. Remove excess mortar on surface and in cavities.
E. Perform job site saw cutting with proper tools to provide straight unchipped edges. Take care to prevent breaking masonry unit corners or edges.
F. Cut mortar joints of block units flush where resilient base is scheduled, cavity insulation vapor barrier adhesive is applied or bitumen dampproofing is applied.

3.4 TOLERANCES

- A. Alignment of Columns: Maximum 1/4 inch from true line.
B. Variation from Unit to Adjacent Unit: 1/32 inch maximum.
C. Variation from Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
D. Variation from Plumb: 1/4 inch per story non-cumulative 1/2 inch in two stories or more.
E. Variation from Level Coursing: 1/8 inch in 3 feet; 1/4 inch in 10 feet; 1/2 inch maximum.
F. Variation of Joint Thickness: 1/8 inch in 3 feet.
G. Maximum Variation from Cross Sectional Thickness of Walls: Plus or minus 1/4 inch.

3.5 REINFORCEMENT AND ANCHORAGES

- A. Install horizontal joint reinforcement 16 inches on center typically and 8 inches at intersection of walls.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend 16 inches minimum each side of opening.
- C. Place joint reinforcement continuous in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Place reinforcing bars supported and secured against displacement. Maintain position within 1/2 inch of true dimension.
- F. Verify that anchorages embedded in concrete and attached to structural steel members are properly placed.
- G. Attach wall ties to wall studs for veneer construction at maximum 16 inches on center vertically and 16 inches on center horizontally. Place at maximum 3 inches on center each way around perimeter of openings, within 12 inches of openings. Place at 8 inches on center at parapets.
- H. Reinforce joint corners and intersections with strap anchors 8 inches on center.

3.6 MASONRY FLASHINGS

- A. Extend flashings through exterior face of veneer, turn up minimum 8 inches and seal onto face of sheathing over stud framed back-up.
- B. Lap end joints minimum 6 inches and seal watertight per manufacturer's recommendation.
- C. Use flashing manufacturer's recommended adhesive and termination sealant.
- D. Create end dams at ends of window heads, at edges of curtain walls, and other vertical elements to channel water to nearest weephole away from window mullions and other items which might allow water to travel vertically.

3.7 LINTELS

- A. Install loose steel lintels as scheduled or shown.
- B. Install precast concrete lintels as scheduled.
- C. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled or shown. Construct lintels using grout filled solid bottom "U" shaped block and reinforcing. Maintain minimum 8 inch bearing on each side of opening. Place reinforcing near bottom of beam.

3.8 GROUTED COMPONENTS

- A. Reinforce bond beams and pilasters as indicated on the Drawings.
- B. Lap splices minimum 36 bar diameters.
- C. Place and consolidate grout fill without disturbing reinforcing.
- D. At bearing points, fill masonry cores with grout minimum 12 inches from opening.
- E. Grout hollow metal frames with joint around frame uniform at 1/4 inch width.

3.9 WEEPS AND VENTS

- A. Install weep holes in veneer at 24 inches on center horizontally for clay masonry and 32 inches on center for 16 inch long concrete masonry, above through-wall flashing, above shelf angles, and at bottom of walls.
- B. After placement of flashing, fill cavity to a depth of six inches with pea gravel.

3.10 CAVITY WALL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep holes. Install mortar net to keep weeps clean.

3.11 CONTROL/EXPANSION JOINTS

- A. Size control joints in accordance with Section 07 92 00 for sealant performance, but in no case larger than adjacent mortar joints in exposed face brick.
- B. Provide expansion joints where shown on the Drawings or as required/recommended by referenced standards.

3.12 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Cooperate with other Sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting any area not indicated or where appearance or strength of masonry work may be impaired.

- C. Sleeve all pipe penetrating masonry walls.

3.13 CLEANING

- A. Remove excess mortar and smears.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with a non-acidic solution which will not harm masonry or adjacent materials. Consult masonry manufacturer for acceptable cleaners. Leave surfaces thoroughly clean and free of all mortar and other soiling.
- D. Use non-metallic tools in cleaning operations.

END OF SECTION

05 05 13 – Shop Applied Metal Coatings

Abstract

This specification covers steel sheet, zinc-coated (galvanized) or zinc-iron alloy-coated (galvannealed) by the hot-dip process in coils and cut lengths. The material is available in several designations as follows: commercial steel, forming steel, deep drawing steel, extra deep drawing steel, structural steel, high strength low alloy steel, high strength low alloy steel with improved formability, solution hardened steel, and bake hardenable steel. Structural steel, high strength low alloy steel, solution hardened steel, and bake hardenable steel are available in several grades based on mechanical properties. Yield strength, elongation, and bending properties of the steel shall be determined. A bend test shall be done to the coated sheets.

1. Scope

1.1 This specification covers steel sheet, zinc-coated (galvanized) or zinc-iron alloy-coated (galvannealed) by the hot-dip process in coils and cut lengths.

1.2 The product is produced in various zinc or zinc-iron alloy-coating weights [masses] or coating designations as shown in Table 1 and in Table S2.1.

(A) The coating designation is the term by which the minimum triple spot, total both sides coating weight [mass] is specified. Because of the many variables and changing conditions that are characteristic of continuous hot-dip coating lines, the zinc or zinc-iron alloy coating is not always evenly divided between the two surfaces of a coated sheet; nor is it always evenly distributed from edge to edge. However, the minimum triple-spot average coating weight (mass) on any one side shall not be less than 40 % of the single-spot requirement.

(B) As it is an established fact that the atmospheric corrosion resistance of zinc or zinc-iron alloy-coated sheet products is a direct function of coating thickness (weight (mass)), the selection of thinner (lighter) coating designations will result in almost linearly reduced corrosion performance of the coating. For example, heavier galvanized coatings perform adequately in bold atmospheric exposure whereas the lighter coatings are often further coated with paint or a similar barrier coating for increased corrosion resistance. Because of this relationship, products carrying the statement “meets ASTM A653/A653M requirements” should also specify the particular coating designation.

(C) International Standard, ISO 3575, continuous hot-dip zinc-coated carbon steel sheet contains Z100 and Z200 designations and does not specify a ZF75 coating.

(D) No minimum means that there are no established minimum requirements for triple- and single-spot tests.

1.3 Product furnished under this specification shall conform to the applicable requirements of the latest issue of Specification A924/A924M, unless otherwise provided herein.

1.4 The product is available in a number of designations, grades and classes in four general categories that are designed to be compatible with different application requirements.

1.4.1 Steels with mandatory chemical requirements and typical mechanical properties.

1.4.2 Steels with mandatory chemical requirements and mandatory mechanical properties.

1.4.3 Steels with mandatory chemical requirements and mandatory mechanical properties that are achieved through solid-solution or bake hardening.

1.5 This specification is applicable to orders in either inch-pound units (as A653) or SI units (as A653M). Values in inch-pound and SI units are not necessarily equivalent. Within the text, SI units are shown in brackets. Each system shall be used independently of the other.

1.6 The text of this specification references notes and footnotes that provide explanatory material. These notes and footnotes, excluding those in tables and figures, shall not be considered as requirements of this specification.

1.7 Unless the order specifies the “M” designation (SI units), the product shall be furnished to inch-pound units.

- 1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

ASTM Standards

A90/A90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A568/A568M Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for

A902 Terminology Relating to Metallic Coated Steel Products

A924/A924M Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

D7396 Guide for Preparation of New, Continuous Zinc-Coated (Galvanized) Steel Surfaces for Painting

E517 Test Method for Plastic Strain Ratio r for Sheet Metal

E646 Test Method for Tensile Strain-Hardening Exponents (n -Values) of Metallic Sheet Materials

ISO Standard

ISO 3575 Continuous Hot-Dip Zinc-Coated Carbon Steel of Commercial and Drawing Qualities

ISO 4998 Continuous Hot-Dip Zinc-Coated Carbon Steel of Structural Quality

END OF SECTION

05 10 00 – DOME STRUCTURES**PART 1: GENERAL****1.1 SUMMARY**

- A. This section includes pre-engineered dome structure framing members only and accessories:
 - 1. Steel splice kits
 - 2. Steel tension ring sections
 - 3. Steel dome ribs
 - 4. Steel compression ring
 - 5. Steel backup plates and fasteners
- B. Finish substrates by others covered in other specification sections.
- C. The dome seismic anchorage system is a deferred submittal. The General Contractor shall contract direct with the dome manufacturer and develop an engineered anchorage system designed by a state licensed structural engineer. Shop drawings and calculations must be submitted to the architect and project engineer for review and approval prior to formal submittal to the city building and safety. The installation of assembly shall not proceed until approved by authorities.

1.2 PERFORMANCE REQUIREMENTS

- A. General: Provide manufactured pre-engineered dome structure and accessories with performance requirements indicated and capable of design requirements for AISC Standard Code of Practice, and wind loading where roof dome has exterior exposure.

1.3 SUBMITTALS

- A. Section 01330-Submittal Procedures: Requirements for submittals.
- B. Product data including manufacturer's product specifications, standard details, and general recommendations, as applicable to materials for each component and for the total dome assembly.
- C. Shop drawing shall have calculations attached that are signed and sealed by a state licensed structural engineer. The drawings must have full details and prepared showing layout of dome components and all accessories.
- D. Manufacturer's assembly instructions to be included.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed metal dome projects or similar projects in scope, material, design and extent to that indicated for this project and with a record of successful in-service performance.
- B. On-site visit and consulting by Manufacturer Representative.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Section 01600 – Product Requirements: Requirements for transporting, handling, storing, protecting products
- B. Deliver dome components and accessories so they will not be damaged or deformed.
- C. Handling: Exercise care in unloading, storing and erecting roof dome components to prevent bending, warping, twisting and surface damage.
- D. Stack materials on platforms or pallets in a straight manner

1.6 PROJECT CONDITIONS

- A. Established Dimensions: Coordinate roof dome assembly with roof dome assembly instructions and actual location of structural members. Ensure opening dimensions correspond to establish dimensions of dome assembly.

1.7 WARRANTY

- A. Submit written warranties, properly identified and executed, covering failure of factory work in summary.
 - 1. Pre-engineered Roof Dome Assembly: 2 years from Substantial Completion.

- City of Rancho Mirage City Project No. CP15-315 Rancho Mirage Observatory□
- B. General: Special warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the contractor under requirements of the Contract Documents.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 COORDINATION

- A. Coordinate the use of steel ribs as structural framing members as approved by Manufacturer and Architect

PART 2: PRODUCTS

2.1 MANUFACTURERS

- A. This section includes pre engineered dome structure framing members only and accessories: Standard of quality to be Ash Domes
- B. Substitutions: Section 01600 – Product Requirements.

2.2 DOME

- A. Basis of Design: Ash Dome LLC pre-engineered roof dome kit
- B. Refer to Drawings for sizes and shapes.
- C. Code: AISC Standard Code of Practice.

2.3 MATERIALS

- A. Steel Plates, Shapes and Bar ASTM A-36
- B. Steel Tube: ASTM A-500
1. Finish: Apply zinc-oxide shop coat after fabrication.
- C. Ribs to meet Manufacturers approved structural engineering. Prior to approval required by Architect

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 – Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify that field conditions are acceptable and are ready to receive Work.

3.2 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Obtain approval prior to site cutting or making adjustments not previously scheduled.

Material:

Galvalume Plus - 24 gauge acrylic coated Galvalume

Custom Colors - offered in 24 gauge galvanized or Galvalume material coated with Kynar 25-Year finishes

Hardware:

Standard: Commercial zinc plated Stainless Steel

Assembly:

- Dome Roof is shipped knocked-down, base attachment angle or brackets
- Available for various mounting requirements
- Panels assembled with wide rib overlapping narrow rib
- Panels held together with a clip/bolt/neoprene washer assembly
- Weather sealing package available

Shipping: The dome roofs are packaged and crated for shipping via commercial carrier

Building Contractor’s RFIF (frequently Asked Questions About Dome Roofs)

- **What materials are used?**

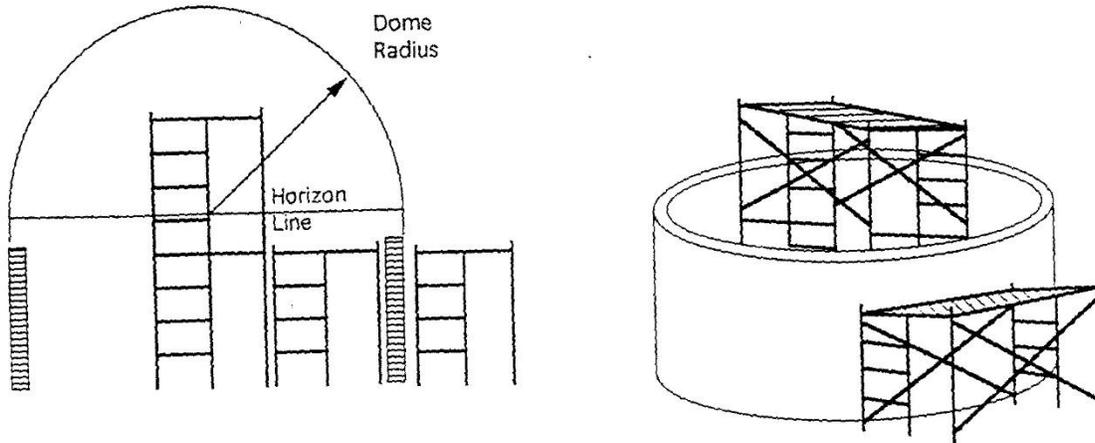
- City of Rancho Mirage City Project No. CP15-315 Rancho Mirage Observatory
- Domes are made from 24-gauge material and supplied with a Galvalume™ "Plus" finish or a variety of quality painted finishes applied over a substrate of G-40 galvalume.*
- **Can a general contractor assemble the dome?**
Yes. With detailed assembly instructions manual, anyone with a basic knowledge of construction can assemble a dome.
 - **What makes your product special?**
Domes are designed to be "self-supporting"; it does not require any superstructure for erection. It is a "free-standing" product.
 - **How do you attach dome to a structure?**
There are a variety of anchoring and/or attachment systems available to meet the numerous design applications for this product. After a review of your plans, the manufacturer's engineer will recommend a system that best meets the specific application.
 - **Is any special reinforcing needed for a manufactured dome roof?**
Depending on the diameter, the geographic and physical location, Reinforcing Kits are generally available. These kits are designed to "hug" the inside wall of the dome and can be applied without detracting from the "effect" of the dome.
 - **Is the dome weatherproof?**
*Domes are weather-resistant, not watertight. For watertight applications, a weather sealing kit is recommended and **required**. An underlying roof presence for inclusion with the design.*
 - **Can the dome be insulated?**
Yes. There are several ways to apply insulation. After reviewing your plans, we will recommend a particular application.
 - **Can the underside of the dome be plaster finished?**
Yes. The dome manufacturer generally offers an additional steel frame attachment assembly that sheet rock and/or plaster can be attached.
 - **What about Wind and Snow load?**
Manufacturer has available testing data for wind load and snow load (based on a computer model and tested to a national standard.) They can also have certified wind load testing for our large hemispheric domes. Because each municipality has its own "Code" that needs to be met, and the variety of ways attachment is applied, the manufacturer can make specific engineered recommendations to spec the dome to the specific application

ASH-DOME ASSEMBLY INSTRUCTIONS

GENERAL INFORMATION

Every ASH-DOME unit is completely fabricated, components numbered, inspected, thoroughly tested for operation, disassembled, cleaned and remarked before being packed for shipment. Average carpenters or mechanics shall not find the assembly difficult. With the exception of an *Engineers Leveling Instrument*, the entire assembly process can be completed with the hand tools found in an average carpenters or mechanics toolbox.

Most of the assembly work is done from the center of the dome, it is suggested a platform or scaffolding be erected approximately 4 or 5 feet below the top of the finished dome height. A person needs to be able to work at chest height in the center of the dome. All of the dome roof panels, the shutter track rails, the observing aperture trim members, the shutter drive assembly and the shutter itself will be installed from this center platform. It is also necessary to have a work platform available for a worker on the outside of the support wall for the installation of all nuts, bolts and screws around the outside of the dome structure. The top of the wall should be a knee height. When the dome track and skirt have been assembled the dome is continually turned to this installer. It is not necessary for this person to move from this location.



UNLOADING THE DOME COMPONENTS

Wear gloves. Most of the parts will not be that heavy but being long and in a radius they are awkward to handle. It is suggested that all dome parts be removed from the pallet or crate and laid out in an orderly manner. Similar parts lay together. This will acquaint the mechanic with the general appearance of the parts and provide him with a reasonably good concept of the eventual locations during the assembly. You will find most parts are readily identifiable by their general appearance. Others are numbered to aid in locating their final positions. Please keep in mind while unloading that all parts are ONE of ONE.

CAUTION

DO NOT attempt to assemble an ASH-DOME unit during periods of high or gusting winds. Unexpected gusts may cause an installer to lose a roof panel or a high gust could tear apart a partially assembled dome from the structure. With the exercise of a reasonable amount of care, and closely following these instructions, it is certain the final result will be a very high quality observatory dome structure with excellent operating characteristics.

STEP #1 - INSTALLATION OF CIRCULAR WALL PLATE ASSEMBLY

Remove all excess cement and mortar from the top of the support wall. **THIS IS IMPORTANT**, the ASH-DOME wall plate must lay flat and level to ensure all the following components will align properly during the fabrication. All anchor bolts should be straightened to a vertical position, (straight up and down). The ASH-DOME wall plate assembly consists of circular segments which when fastened together form a continuous circular base plate with the dome roller fixtures attached and evenly spaced.

1.1

- a) Interlock the segments in a manner that brings similar numbers to be adjacent at the spliced joints (Page #1). Install the WALL PLATE SPLICE BOLTS at this time.
- b) Next install the dome azimuth roller fixtures at each splice in the wall plate. The nuts on the bolt holding the dome azimuth roller fixtures should be drawn down tightly, and then backed off until slightly tighter than finger tight. This allows the hard rubber cushion to act as a cushion to make up for any slight variations in the level plane of the wall plate assembly when finished.
- c) Rest the circular wall plate upon the protruding ends of the anchor bolts and layout the bolt locations for drilling.

1.2

- a) Note the location of the azimuth motor mounting bolts. This is where the drive is secured to the wall plate. Then shift the all plate assembly around until the azimuth drive motor is in an ideal location for electrical

connections and to minimize interference between anchor bolts and dome support roller fixtures. *Most Northern hemisphere astronomers prefer to locate the azimuth drive unit in a Northern quadrant.*

- b) Adjust the entire wall plate assembly to become concentric with the support foundation wall. Check the outside diameter of the circular wall plate at many points and make any necessary adjustments to cause the plate to be resting in a truly circular configuration. When the outside diameter measurements are equal length, the wall plate assembly will be resting in a true circle.
- c) Next mark the locations of the anchor bolts and drill the holes. Drill the holes slightly larger than the diameter of the anchor bolts. (It may be necessary to cut anchor bolts off at some locations of wheel fixtures or the azimuth motor mount.)
- d) Lower the wall plate assembly down over the anchor bolts to a resting position on the wall top.
- e) Now, using a leveling instrument determine the highest elevation around the top of the support wall. Record the elevations along the inside or outside edge of the wall plate. When the high point has been located, *further elevate this point by approximately 1/4" by inserting tapered shims between the underside of the plate and the wall top on either side of the anchor bolt, as indicated on ASH-DOME supplied drawing R-100 (p39).*
- f) Install a washer and nut on this anchor bolt and draw the nut down tight. This is the highest elevation on your support wall. You must bring all the other points up to this elevation by using the leveling instrument and the tapered shims provided.
- g) Adjust the entire wall plate to this elevation and secure to the support wall.

DO NOT take the elevations from the top of the roller fixtures attached to the wall plate.

1.3

- a) Taking elevations from the fixture on the rubber isolation pad will not give you an accurate reading. When the entire wall plate assembly has been adjusted to a flat and level plane, it will be noted the width of the space between the underside of the wall plate and the wall top will vary as the elevations of the support wall top vary. This space should be filled with a cement grout or dry pack material at this time; however, *it can be done after the completion of the dome.*
- b) Recheck all elevations and outside diameter measurements, make any adjustments necessary to attain a truly circular, flat and level wall plate assembly. *It is essential you use care in these adjustments of the wall plate assembly.* This will guarantee the finished observatory dome structure will move in azimuth without a binding action in the dome support track rail or support rollers. Also by starting the assembly from a level plain the following components will come into alignment much easier.
- c) Trim off any excess length on the adjusting shims before installing the dome support track rails. The shims should be cut flush with the edges of the wall plate assembly. *Take care not to loosen the shims during trimming.*
- d) Cut off any extra length from the anchor bolts at this time.

STEP #2 -INSTALLATION OF DOME SUPPORT ROLLERS AND TRACK RAILS SECTIONS

2.1

- a) Apply any good grade of all weather lubricating grease to each dome support roller shaft and insert the shafts into the fixtures mounted about the wall plate (Page #1).
- b) When a minimum amount of lateral (run out) movement is desired, install a spacer washer on the roller shaft before inserting it into the roller fixture. This will not be required on each roller shaft but they should be spaced evenly.
- c) When all dome rollers have been mounted, install one segment of the dome track by inserting one end of the track over a roller.
- d) Now, roll the segment over the following dome rollers until the track segment is supported on the dome rollers. Note the number on the ends of the track rail and install following segments in a manner, which causes similar numbers to become adjacent (Page #2).

- e) As each additional track segment is installed, it must be bolted to the previously installed segment. This joint is made at the over lap or splice joints. Use the 5/16" x 3/4" low profile truss head bolts, these will be marked BOTTOM TRACK SPLICE NUTS & BOLTS.
- f) Install only the bolts that are in a straight up-and-down position. These go on the inside of the dome track, the bolts go down, and the nuts go on the bottom side of the dome track. This allows the dome track rail to roll around the wall plate assembly without any obstructions.
- g) The horizontal holes are used for the next step of the assembly. During the installation of the dome track rail segments, *care must be exercised* to prevent the support roller shafts from sliding out of the mounting fixtures. Roll the dome track on keeping it tight to the wall plate, as it will roll off just as easy as it rolls on at this time. **Don't let the dome track rail fall from the structure**, this could result in a radius change and in a track rail that may not turn as freely as it should.
- h) When all the segments have been installed and bolted together the track should revolve freely. The track may appear to be somewhat loose at this time but this characteristic shall not be apparent after the dome roof panels are in place.

STEP #3 - DOMESKIRT ASSEMBLY

3.1

The dome skirt, which is installed around the outside of the dome track, is made of sections of 14 Gage galvanized steel with curved angles spot-welded to them [\(Page #3, 4\)](#). These sections sit on the outside edge of the dome track rail.

- a) Locate the BACK CENTER marked on the dome track rail. This should be clearly marked and is directly across from a mark indicating the FRONT CENTER. Start with the section marked BACK CENTER.
- b) Bolt in place using 5/16" x 3/4" stainless steel truss head bolts. These will be marked SKIRT NUTS & BOLTS. The bolts go from the inside of the dome skirt out. The nuts are on the outside of the dome skirt.
- c) Continue with sections on either side of BACK CENTER bringing the similar numbers together.
- d) The last skirt section is installed by slipping one end of the panel into place. Then slide the other end down and locking it into place. Use these same nuts & bolts, 5/16" x 3/4" for the splice joints on the skirt panels also.
- e) It is recommended all nuts and bolts be installed and then go back and tighten all SKIRT BOLTS at the same time. This will make any final alignment much easier.

STEP #3a - AZIMUTH DRIVE GEAR RACK

3.2

You will see 1/4" holes drilled in the dome skirt sections just above the dome track rails. This is the location for mounting the azimuth gear rack [\(Page #5\)](#).

- a) Position the gear rack with "BACK CENTER" at the "BACK CENTER" of the dome skirt. As in earlier steps, align numbers to similar numbers.
- b) Fasten the sections together with the self-tapping, sheet metal screws provided. These will be marked AZIMUTH GEAR RACK SPLICE SCREWS. It may be necessary to shim the azimuth gear rack, to keep it centered within the dome skirt. These locations are noted near the hole on the inside of the skirt panel.
- c) The azimuth gear rack is secured to the skirt by using self-tapping screws. These screws are feed from the outside of the skirt, through the gear rack and tap into a GEAR RACK CHAIR.
- d) These chairs support the gear rack above the dome track and also hold it in place.
- e) *It is suggested you secure the azimuth gear rack starting at the quadrants*. If shims are required, start these also at the quadrants first. This will aid in keeping the azimuth drive track centered in the dome skirt.

STEP #4 - INSTALLATION OF THE DOME ROOF PANELS

4.1

Your ASH-DOME has been fitted with a circular reinforcing pipe ring. This ring is secured to the inside of the dome with fittings, which are attached to the ribs of each dome panel (see ASH-DOME Drawing R-105 - page 42). An examination of the dome skirt will reveal "FRONT CENTER" and "BACK CENTER" points have been marked on the skirt panels. The "BACK CENTER" point indicates one end of a center line through the hemisphere of the dome. This point is where you will begin installing the roof panels (Page #6, 8, 9). *It should be noted that all roof panels are numbered at the bottom (wide) end, on the inside.* These are the only numbers you are concerned with at this time.

- a) The first panel to be installed is marked BACK CENTER and a number. The center of this panel will go on the BACK CENTER of the dome skirt.
- b) These panels should fit flush on the outside trim angle of the dome skirt. One person stands on the scaffolding in the center of the dome cylinder. This person holds the roof sheet while the other person aligns the screw holes. The sheet metal screws, rib spacers and bolts are installed at this time. These items are marked ROOF SHEET SCREWS and BOTTOM RIB BOLTS.
- c) Install the roof sheet screws first. Screw the screw in next to the dome rib first. By doing this you allow for adjustments to help align other holes.
- d) Next install the RIB BLOCK, rib bolt and nut securing the rib to the skirt. *It is suggested you do not tighten the rib nuts and bolts completely until all roof sheets are in position.* The bolts go from the outside in, nuts on the inside.
- e) Note the number on the bottom end of the starting roof panel and install all the other panels in a manner, which causes the numbers to increase in a clock-wise direction or to decrease in a counter clock-wise direction. You are working from the center of the hemisphere toward the dome aperture from each side. It is suggested you install a few of the panels *each way* from the BACK CENTER to help bring the roof into shape.
- f) All panels are installed from the scaffold or platform inside the dome.
- g) The bottom end of each successive panel is entered into the top of the preceding roof panel's rib.
- h) The next panel is then slid downward through the interlocking rib joint until it comes to rest in a position on the dome skirt angle. *It is suggested you use liquid soap or other non-oil lubricant on the edges of the interlocking panels.* Remember to try and push in a circular manner, along the curve of the roof. The roof sheet will slide in and out of the rib somewhat so as to allow the installation of the sheet metal screws and the rib blocks. *The first several sheets are difficult but as the roof comes into a hemisphere the sheets will slide easier.* **DO NOT DRILL NEW HOLES**, take your time and the panels will come into alignment.
- i) With all the sheets in place, screwed and bolted you now have a semi-rigid dome structure. Remember to *turn the dome and go back around and tighten all RIB BOLTS & NUTS.* Position one person on the inside and one on the outside.

STEP #5 - INSTALLATION OF THE SHUTTER TRACK SYSTEM

5.1

Each shutter track rail is made up of two 1/4-circles of fabricated track. These 1/4 circles are bolted together *before* the track rails are raised into position over the top of the dome. The bolts and nuts are marked SHUTTER TRACK SPLICE NUTS & BOLTS (Page #10, 11).

- a) One shutter track section is positioned along each side of the observing aperture and over the backside of the dome.
- b) Note the location of the bolt holes through the shutter track base angle. Match these to the holes along each side of the aperture and make the identification of the right and left shutter tracks.
- c) The track rails are fastened at the ends first, front and back. Use a "C" clamp at the top of the dome to hold them in place (Page #12).
- d) Bolt the rails on to the rib locations next using the SHIM BLOCKS. One side of the aperture will be marked with lettered blocks; the other side will be numbered blocks.
- e) The wide part of the shim block is installed away from the aperture. This holds the track rail straight up and down.
- f) When the rails are secured, you are now able to bolt the side trim angles into position. The aperture side trim angles are installed along both sides of the observing aperture. These bolts go through the shutter track, the roof sheet and the trim angle, nuts on the inside of the dome. The tapered aluminum shim blocks under the track base angle hold the track rails in a vertical position when the fasteners are drawn down tightly (Page #13, 14).
- g) All shim blocks and their respective locations are clearly marked with numbers or letters. When two blocks are on the same bolt the block that fits on the outside of the dome will be the block with the mark on it. The other block fits in between the trim angle and the dome skin. *This is tricky to get in but, if you take your time, it will fit.*
- h) Work your way up from the bottom of the aperture. By doing this you will draw the following holes into alignment.
- i) When the track rails are in place the internal cross bracing is now ready to be installed. These fit on the inside of the dome and fit onto the bolts that are coming thru the backside of the roof. These locations are also marked (Pages #15, 16, 17, 18).
- j) When installing the shim blocks on the back side of the dome you **must** put putty around the bolt on the inside of the dome along with the specified number of spacer washers to *guarantee that leaking will not occur around these bolts.*
- k) The Motor Bar supports the back end of shutter drive motor unit. This will be marked MOTOR BAR.
- l) The Top Bar supports the front of the shutter drive motor, and is marked TOP BAR. This is a heavy angle that has a plate bolted onto it and mounts across the top of the aperture.
- m) Use the TOP BAR RIB NUTS, BOLTS AND BLOCKS and secure this angle into position. These rib blocks will only fit one way and are rights and lefts.
- n) Next install the gear hole frame marked GEAR HOLE TRIM at the top of the aperture. This installs coming from the inside and slipping into position between the roof panels and the TOP BAR. This is the location where the shutter drive gear meets the shutter gear rack.
- o) Next install the BACK SHUTTER SEAL ANGLE (Page #20). This is mounted on the outside of the dome just past the gear hole trim. It will fit in-between the shutter tracks; the flange of the angle faces the gear hole trim. Use the bolts marked BACK SEAL ANGLE BOLTS. The bolts go down into the dome, nuts on the inside.
- p) There are two diagonal track rail braces on the back of the dome. These are marked BACK BRACES, Right & Left and should be installed at this time.

STEP #6 - INSTALLATION OF THE SIDE WEATHER SEALS AND GLAZING

6.1

- a) The SIDE WEATHER SEALS are now ready to be mounted (Page #19). The weather seals fit along either side of the dome aperture and bolt to the side of the shutter tracks. In order to mount the sections you must remove the nuts from the shutter track splices and fit the assembly over the track rail bolts first.
- b) After all parts of the shutter track, side weather seal system and back shutter seal angle are secured in place, you now have to caulk the dome (Page #21). This glazing compound is squeezed into the space between the track rails and the skin of the dome, up both sides of the aperture. You start at the bottom and work your way up, across and under the back shutter seal angle and down the front. **DO NOT CONTINUE OVER THE BACK PAST THE BACK SEAL ANGLE.** You are only sealing the area under the dome shutter when it is in the closed position.
- c) Make certain that you have sealed all openings leading into the aperture completely. It is also recommended that a small amount of tube caulking be used around the head of each bolt used to secure the shutter track rails.

STEP #7 -INSTALLATION OF THE REINFORCING RING

7.1

All ASH-DOMES with a diameter larger than 12'6" are built with one or more reinforcing rings installed. A reinforcing ring consists of a number of circular segments of steel tubing with adjustable ends (Page #22). The ring is held in position on the inside of the dome by means of a fixture attached to the rib of each roof panel. The rail segments are clearly marked to indicate the sequence of assembly. A BACK CENTER point is indicated on one of the circular tube segments.

- a) This mark must coincide with the BACK CENTER point of the dome.
- b) Other segments are marked so as number aligns to number. The rail ends secure to the sides of the observing aperture with readily identified fixtures.
- c) Start at this "BACK CENTER" and work your way around to the aperture, securing the clips as you go. The adjustable ends will bolt onto the sides of the aperture. When these ends have been secured, tighten the setscrews.

8.1

All shutter drive gear units are mounted in the same manner, whether manually or electrically operated.

- a) Remove the two small retaining angles which are bolted through slots at the top of the gear housing (Page #23). The purpose of these angles is to lock the gear in mesh with the shutter drive track after the shutter has been installed. The shutter drive track runs down the center on the upper shutter section.
- b) Remove one nut (flex lock nut) and washer from the front support bolt; also remove the flex lock nuts from the brackets at the back of the motor assembly.
- c) Lift the unit into position and insert the 1/2" bolt through the slotted hole at the center of the top bar.
- d) Replace the washer and the self-locking nut to hold the motor drive unit in position.
- e) Bolt the hanger bolts into the holes drilled in the motor bar and tighten so as to *just start to squeeze* the rubber grommet on the bolt.
- f) Leave the self-locking nut on the front support bolt loose at this time.

STEP #9 -INSTALLATION OF THE SHUTTER SECTIONS

9.1

The main shutter section may now be raised into position over the observing aperture. Lift it on to the dome, resting upon the shutter track rails and side weather seal strips. Make certain the end with the back shutter seal is up, the over lap will be the bottom of the door (Page #24, 25).

9.2

- a) Remove the support roller mounting fixtures from the shutter side rails; insert the shaft of the support roller into each fixture.
- b) Then replace each fixture with the roller intact, locking it into the track rail. It is necessary to elevate the shutter somewhat to replace the fixtures with the roller installed. When all the rollers are in place, slide the shutter section upward until the top end is well past the back shutter seal angle. **DO NOT PUSH THE SHUTTER OVER THE BACK SIDE OF THE DOME. BE CAREFUL: SECURE THIS SECTION WITH A VISE GRIP IN THE TRACK SO THE SHUTTER CANNOT MOVE EITHER DIRECTION.**
- c) Now the shutter drive track is positioned over the shutter drive gear unit. Raise the shutter drive gear unit upward until the gear is meshed with the shutter drive rack, and reinstall the two small angle brackets which lock the gear into this position. Some slight forward or backward adjustments may be necessary to position the angles to allow freedom of movement, yet maintaining a permanent lock between the drive gear and the shutter drive track. Shifting the angle fastener bolts slightly in the curved mounting slots cut into the shutter drive gear housing does this. The angles must appear to lie on the top of the shutter drive track.
- d) Tighten the nut on the shutter drive unit front support bolt, allow about 1/32" clearance to provide this bolt to shift with the movement of the shutter. This movement is necessary because of possible wind loading.
- e) After this is done, the shutter drive unit cannot move except unless it is electrically operated.
- f) Install the short shutter section in the same manner. Make certain the locking device is upward and will be in proper position so that when the two sections are brought together they meet and lock. Since this is a TYPE "B" style dome, the lower door is mounted on hinges and the two sections should meet evenly (Page #26).
- g) Run the main shutter section open and install the BACK SHUTTER SEAL.
- h) Bring the lower door section up, also and install the front shutter seal. Some adjustment may be necessary so the shutter stops in the correct position.

STEP #10 -INSTALLATION OF AZIMUTH DRIVE AND WEATHER SEAL

10.1

- a) Insert the weather seal over the bolts and roller fixtures around the wall plate assembly. The edge of this seal should wipe against the inside of the dome track and fit into the space between the track and azimuth gear rack (Page #29).
- b) The opening between the dome track rail and the topside of the wall plate assembly is very effectively sealed using this method.
- c) The azimuth drive seal mounts at the location where the azimuth motor mounts. This is where you start with the rubber seal and end with the roll of rubber. This piece fits under the motor so as to prevent dust from blowing in around the motor (see ASH-DOME drawing R-104 – page 41).

STEP #11 - INSTALLING THE AZIMUTH DRIVE UNIT

11.1

The location of this drive unit should already be known. It has also been marked clearly on the wall plate assembly.

- a) Two mounting bolts are extending upward from this location through the azimuth motor seal (see ASH-DOME drawing R-105 – page 42).
- b) Mount the unit in a manner, which causes the drive gear to mesh with the circular azimuth gear rack. It should remain in this position throughout one complete revolution of the dome. *It may be necessary to shift the unit somewhat to accomplish this.*
- c) Using the hex nut and the locking wing nut, adjust gear down into the azimuth drive track.
- d) Tighten the hex nut down until light pressure is applied to the circular rack.
- e) Then lock the hex nut using the wing nut. The gear should more or less float in this rack while remaining engaged.

STEP #12 - LUBRICATION

12.1

All dome and shutter support rollers have ball bearings. These have been lubricated.

- a) It is suggested that the inside configuration of all shutter and dome support track rollers be lubricated with the same type lubricating oil.
- b) It is important that the top and sides of the shutter drive rack be greased over the length of the drive rack; also grease the rack openings, which come into contact with the shutter drive gear.
- c) The drive motor gearboxes are filled with lubricating oil at the factory, however, it is suggested that the oil level be checked and oil added if necessary. Any good grade all temperature oil should be suitable.

Construction of your Ash-Dome is now complete. Congratulations!

PAINTING

All ASH-DOMES are fabricated of galvanized and Galvalume steel. These materials do not require painting, but some purchasers choose to do so. Should it be desired to paint your observatory, clean the surface with a detergent and rinse. This will remove any oils used during the roll forming process. It is recommended you contact a local paint supplier and seek a paint used on commercial metal buildings.

OWNERS RESPONSIBILITIES

As the owner, you are responsible for maintaining your ASH-DOME properly. Repairs required as a result of failure to maintain your Ash-Dome properly are the owner's responsibility.

SHOULD YOU HAVE ANY QUESTIONS, PLEASE CALL.

ASH MANUFACTURING COMPANY
P.O. Box 312
Plainfield, Illinois USA 60544

Phone: (815) 436-9403
Fax: (815) 436-1032
Email: ashdome@ameritech.net

HAND TOOLS REQUIRED

Electric Power to operate dome and power tools (110V, 1PH, 60CYC)

1 - metal cutting saw
 1 - saw for cutting wood
 1 - electric drill (3/8" variable speed)
 1 - impact screw gun (electric screw driver)
 1 - 5/16" & 3/8" nut driver ends for screw gun
 2 - 1/2" open end wrenches
 2 - tapered drift pin (tool used to align holes in metal)

1 - 3/8" nut driver
 1 - 11/32" nut driver
 2 - straight blade screw drivers
 1 - Phillips (cross head) screw driver
 1 - caulking gun
 1 - steel banding cutter
 1 - pair of gloves for every worker
 1 - razor knife

2 or 3 people accustomed to working with mechanical things – accustomed to working construction and have some working knowledge of how wooden and metal buildings are assembled

1 - 1/4 " masonry drill bit
 1 - Saber saw
 1 - Hack saw
 1 - Large pair of scissors

1 - Electrical extension cord 110V

1 - scaffolding
 2 - ladders (of sufficient length)
 2 - hammers
 1 - 8" Crescent wrench
 1 - 4 ft level
 1 - 20 ft tape measure
 1 - wood drill bit, slightly larger than the anchor bolt diameter
 1 - set of open end, wrenches 3/8" - 3/4"
 1 - ratchet set 3/8" drive 7/16" - 3/4" deep sockets
 2 - pry bars
 2 - putty knives
 2 - "C" clamps (large)
 3 - vise grips (locking pliers)
 1 - length of rope
 1 - Drill index 1/8 – 1/2
 1 - Engineers level. This must be used to level the ASH-DOME wall plate assembly to + or - 1/32")

1 - Skill saw for cutting wood
 1 - 3/4" wood drill bit
 2 - bar clamps (18")

WILL ALSO REQUIRE

1. Good grade all weather lubricating grease
2. Good grade all temperature oil for lubricating driver motor gear boxes

05 12 00 – STRUCTURAL STEEL FRAMING**PART 1 GENERAL**

1.1 SECTION INCLUDES

- A. Structural steel framing members, base plates, plates, and grouting under base plates.
- B. Section 03 15 00-Concrete: Placement of anchors for casting into concrete.
- C. Section 04 05 00-Masonry Work: Placement of anchors for embedding into masonry.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate sizes, spacing, and locations of structural members, openings, connections, cambers, loads, and welded connections.

1.3 QUALITY ASSURANCE

- A. Fabricate structural steel members in accordance with AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Structural Steel Members: ASTM A36.
- B. Structural Tubing: ASTM A501.
- C. Pipe: ASTM A53, Grade B.
- D. Bolts, Nuts, and Washers: ASTM A325, galvanized to ASTM A153 for galvanized members.
- E. Anchor Bolts: ASTM A307.
- F. Welding Materials: AWS D1.1; type required for materials being welded.
- G. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 7,000 psi at 28 days.
- H. Shop and Touch-Up Primer: SSPC 15, Type 1, red oxide.

2.2 FABRICATION

- A. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

2.3 FINISH

- A. Prepare structural component surfaces in accordance with SSPC SP 2.
- B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.2 ERECTION

- A. Allow for erection loads. Provide temporary bracing to maintain framing in alignment until completion of erection and installation of permanent bridging and bracing.
- B. Field weld components indicated on Drawings and shop drawings.
- C. Do not field cut or alter structural members without approval of Architect/Engineer.
- D. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- E. Grout under base plates in accordance with Section 04 05 00.

3.3 FIELD QUALITY CONTROL

- A. Field inspection of members, connections, and torquing.

END OF SECTION

05 40 00 – COLD FORMED METAL FRAMING**PART 1 GENERAL**

1.1 SECTION INCLUDES

- A. Load bearing formed steel stud framing.
- B. Formed steel joist, purlin, slotted channel framing and bridging.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, type and location of fasteners, and accessories or items required of related work.
- B. Indicate stud, floor joist, ceiling joist, roof joist, roof rafter, and roof truss layout.
- C. Product Data: Describe materials and finish, product criteria, and limitations.

PART 2 PRODUCTS

2.1 FRAMING MATERIALS

- A. As specified on Drawings.

2.2 ACCESSORIES

- A. Bracing, Furring, Bridging, Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered; same finish as framing members.
- B. Screws: ASTM A90, hot dip galvanized, self-drilling, self-tapping.
- C. Anchorage Devices: Power actuated or Drilled expansion bolts.
- D. Welding: In accordance with AWS D1.1 and AWS D1.3.
- E. Primer: Touch-up for galvanized surfaces.

2.3 FABRICATION

- A. Fabricate assemblies of sizes and profiles required; with framing members fitted, reinforced and braced.
- B. Fit and assemble in largest practical sections for delivery to site, ready for installation.

2.4 FINISHES

- A. Studs and Accessories: Galvanize to G90 coating class.
- B. Joists, Purlins and Accessories: Galvanize to G90 coating class.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that substrate surfaces are ready to receive work.

3.2 ERECTION OF STUDDING

- A. Install components in accordance with manufacturer's instructions.
- B. Align floor and ceiling tracks; locate to layout. Coordinate installation of sealant with floor and ceiling.
- C. Construct corners using minimum three studs. Double stud wall openings, door and window jambs.
- D. Erect load bearing studs one piece full length. Splicing of studs is not permitted.
- E. Allow for deflection, directly below horizontal building framing for non-load bearing framing.
- F. Attach cross studs/furring channels to studs for attachment of fixtures anchored to walls and for attachment of mechanical and electrical items within walls.
- G. Touch-up field welds and damaged prefinished surfaces with primer.

3.3 ERECTION OF JOISTS/PURLINS

- A. Install framing components in accordance with manufacturer's instructions.
- B. Make provisions for erection stresses. Provide temporary alignment and bracing.
- C. Set joists parallel and level, with lateral bracing and bridging.
- D. Locate joist end bearing directly over load bearing studs or provide load distributing member to top of stud track.
- E. Provide web stiffeners at reaction points.
- F. Touch-up field welds and damaged prefinished surfaces with primer.

END OF SECTION

05 50 00 – METAL FABRICATIONS**PART 1 GENERAL**

1.1 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on Drawings.

1.2 COORDINATION

- A. Coordinate and verify required access door sizes and locations with applicable trades.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Steel Sections: ASTM A 36; ASM A992 for wide flanges.
B. Steel Tubing: ASTM A 500, Grade B.
C. Steel Pipe: ASTM A 53, Grade B, Schedule 40.
D. Bolts, Nuts, and Washers: ASTM A 307, Grade A.
E. Welding Materials: AWS D1.1; type required for materials being welded.

2.2 FABRICATION

- A. Verify dimensions on site prior to shop fabrication.
B. Fabricate items with joints tightly fitted and secured.
C. Fit and shop assemble in largest practical sections, for delivery to site.
D. Grind exposed welds flush and smooth with adjacent finished surface. Ease exposed edges to small uniform radius.
E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of structure, except where specifically noted otherwise.
F. Make exposed joints butt tight, flush, and hairline.
G. Supply components required for anchorage of metal fabrications. Fabricate anchorage and related components of same material and finish as metal fabrication, except where specifically noted otherwise.

2.3 UNIVERSAL PRIMER

- A. Manufacturer's standard, lead free primer, capable of providing sound foundation for field applied top coats despite prolonged exposure.
B. Standard: FS TT-P-645.
C. Maximum Allowable Dry Time: 4 hours to touch; 24 hours to re-coat.
D. Compatible with finish paint system specified in 09900 or 09965, as scheduled or noted.
E. Acceptable Products (subject to compatibility with finish coating):
1. Tnemec, Chem Prime 37H-77, Tnemec, Kansas City, MO.
2. Valspar 13-Y-5, Valspar, Baltimore, MD.
3. Carboline Multi-Bond 150, by Carboline Company, St. Louis, MO.

2.4 ZINC-RICH PRIMER

- A. Inorganic, zinc-rich, capable of providing sound foundation for field applied top coats despite prolonged exposure, cathodic protection and corrosion resistance.
1. Pigment Content: Minimum 80 percent zinc in dry film by weight.
2. Compatible with finish paint system specified in Section 09 91 00.
B. Acceptable Products:
1. Valspar MZ-7 (13-F-12) by Ameron, Baltimore, MD.
2. Tnemec N90-392 Tneme-Zinc, Tnemec Co., Kansas City, MO.

2.5 GALVANIZING

- A. Provide hot-dip galvanized coating in accordance with:
1. ASTM A 153 - Iron and Steel Hardware.
2. ASTM A 123 - Rolled, pressed and forged steel shapes, plates, bars and strips 1/8 inch thick and heavier.
B. Galvanizing Repair Paint:
1. Standard: MIL-P-21035 or SSPC-Paint-20.
2. Acceptable Products:

- a. Valspar M-Z-2 (13-F-2), Valspar, Baltimore, MD.
- b. Tnemec 90-93, Tnemec Co., Kansas, MO.

2.6 FINISH

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact bond with concrete or where field welding is required.
- C. Prime paint interior steel items scheduled with two coats of primer.
- D. Galvanize exterior steel items and those touching exterior masonry walls to minimum 2.0 ounces per square foot zinc coating in accordance with ASTM A 386. Finish coating surface to be smooth, without irregularities, drip marks, or other roughness, ready for priming with minimal preparation required.

2.7 STEEL LINTELS

- A. Provide at wall opening and recesses.
- B. Weld multiple loose lintels to form a single unit.
- C. Provide a minimum of 8 inches of bearing at ends unless noted otherwise.
- D. Finish: Prime painted.

2.8 PIPE BOLLARDS

- A. Type: Standard steel pipe.
- B. Fill with standard weight concrete; set in concrete foundations. Ensure concrete at top of pipe is rounded and smooth.
- C. Finish: Galvanized.

2.9 VERTICAL LADDERS

- A. Type: Vertical steel ladders consisting of following components:
 1. **Side Rails: 3/8 inch by 2-1/2 inches flat steel bars with eased edges spaced as detailed on Drawings or not less than 18 inches between.**
 2. **Rungs: 1 inch minimum solid round steel bars spaced 12 inches maximum on center, punched through stringers and plug welded.**
 3. **Provide non-slip surface on top of each rung, either by coating rung with aluminum oxide granules set in epoxy resin adhesive, or by using type of manufactured rung which is filled with aluminum oxide grout.**
 4. **Angle Supports: Support ladders by steel angles bolted to walls and floors to provide minimum of 7 inches from face of wall to centerline of rungs. Locate at 5 feet on center and within 16 inches of top and bottom.**
 5. **Safety Handrails: Extend rails 42 inches above top rung and anchor to structure, if adjacent structure does not extend above top rung, gooseneck extended rails back to structure.**

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects. Adequately reinforce and anchor work in place. Form exterior joints to exclude water.
- B. Perform field welding in accordance with AWS D1.1, D1.2 or D1.3 depending on substrate involved.
- C. After installation, touch-up field welds, scratched or damaged surfaces with primer.
- D. Install stock manufactured items in accordance with manufacturer's directions.

3.2 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

3.3 SCHEDULE

- A. Provide and install items listed in Schedule and shown on Drawings with anchorage and attachments necessary for installation.
- B. The Schedule is a list of principal items only. Refer to Drawing details for items not specifically scheduled.
- C. Items of Work Custom Fabricated
 1. **Bumper bollards and guard rails; schedule 40 steel: Galvanized finish.**

2. **Lintels, ledges, shelf angles, channels and plates not attached to structural framing, for support of metal decking and masonry: Prime paint finish.**
3. **Miscellaneous Steel Shapes: Channels, wide flange shapes, angles, plates, tubing, connections, and bolts where shown and detailed on Drawings. Hot dip galvanize where exposed to weather or touching exterior masonry after fabrication.**

END OF SECTION

06 10 00 – ROUGH CARPENTRY**PART 2 GENERAL****2.1 QUALITY ASSURANCE**

- A. Lumber Grading: Lumber Grading Rules and Wood Species in accordance with Voluntary Product Standards. Grading rules of following associations apply to materials furnished.
- 1. Southern Pine Inspection Bureau (SPIB).**
 - 2. West Coast Lumber Inspection Bureau (WCLIB).**
 - 3. Western Wood Products Association (WWPA).**

2.2 DELIVERY, STORAGE AND HANDLING

- A. Store products above ground, on platforms or skids, and covered with waterproof coverings. Provide for adequate air circulation.
- B. Do not store seasoned materials in damp or wet locations.
- C. Support products in such a way as to prevent warping and distortion.

PART 3 PRODUCTS**3.1 WOOD MATERIALS**

- A. General: Where stress rating values are given in lieu of grades, select any quality which will meet structural requirements. Comply with all general notes, specifications, schedules and details on structural drawings.
- B. Lumber
- 1. Grading Rules: PS 20.**
 - 2. Moisture Content: 19 percent maximum moisture content after treatment for fire retardant and preservative treated woods.**
 - 3. Surfacing: Surface four sides (S4S), unless noted otherwise.**
 - 4. Uses, Grades, and Stress Ratings**
 - Non-structural Framing (2 to 4 inch thick, 2 to 4 inch wide):
 - Plates, Blocking, Bracing, Nailers: Utility grade.
 - Structural Framing: Refer to structural drawings and structural calculations.
- C. Plywood
- 1. Grading Rules: PS 1, using group 1 to 4 species as required for rating.**
 - 2. Exposures: Provide exposure ratings as indicated.**
 - 3. Thickness: As detailed or noted, or otherwise as required to maintain span capability.**
 - 4. Uses, Grades, Ratings**
 - As indicated in drawings.
 - 5. CAL Green: Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in ARB's Air Toxics Control Measure for Composite Wood (17 CCR 93120), by or before the specified in those sections as shown in Table 4.504.5.**
 - Verification of compliance shall be provided when requested by enforcing agency.
 - Documentation shall include at least one of the following: Product certifications and specifications, Chain of custody certifications, or other methods acceptable to the authority.

3.2 ACCESSORIES

- A. Fasteners
- 1. Provide fasteners in sizes, spacing, and locations to suit applications. Hot dip galvanize unless noted otherwise.**

3.3 WOOD TREATMENTS - SHOP PREPARED

- A. Preservative Treated Wood
- 1. Preservative treat all wood in contact w/grade steel or concrete.**
 - 2. Use waterborne salt preservatives as follows:**
 - AWPB LP-2 above ground.
 - AWPB LP 22 ground contact.

PART 4 EXECUTION**4.1 INSTALLATION**

- A. General

1. **Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted. Scribe and cope as required.**

4.2 TOLERANCES

- A. Framing members: 1/4 inch maximum from true position.
- B. Surface flatness of floors/roofs: 1/4 inch in 10 feet maximum.

END OF SECTION

06 15 00 – IPE SHTG. VENEER / DECKING**PART 1 - General Consideration:****1.1 SUMMARY**

- A. **Ipe** is an extremely dense, tropical hardwood with exceptional natural durability and insect resistance.
- B. When properly installed, paying attention to the natural characteristics of the wood, an Ipe deck can be expected to literally give a lifetime of service with as much maintenance as the customer desires. It is the only deck product available today that can claim to have a real potential for **ZERO MAINTENANCE** over its useful life.

1.2 Customer Storage and Handling Considerations:

- A. **Ipe** is supplied to distributors, like J.H. Monteath Lumber Co., as partially air-dried lumber intended for outdoor use only.
- B. Ipe boards should be stored out of direct sunlight and like any other professional use of solid wood, the boards should be allowed to acclimate and stabilize at the prevailing humidity levels of the environment before installation.

C.

1.3 Air Flow and Spacing Consideration Upon Installation:

- A. Allowances for suitable groundside ventilation is crucial in order to assure proper air circulation and absolute necessity for the long-term stability of an **Ipe** deck. Since all species of wood, including **Ipe**, react to moisture and temperature, it is essential that the wood be allowed "to breathe" upon its installation.
- B. In order to allow for the natural expansion and contraction of a solid wood product like **Ipe**, installation should provide for a minimum of 1/16" gap between the deck boards to aid in air circulation. After two full seasons, fully seasoned shrinkage rates of approximately 1/16" on 4" wide boards to 1/8" on 6" wide boards can be expected.

1.4 Cutting and Drilling Considerations:

- A. Although very dense species like **Ipe** can be worked with standard carbide tipped saw blades and router bits, the use of contractor quality cobalt drills and similar countersinks will give the longest tool life and best results.
- B. **Ipe**, like all species of wood, is most vulnerable to degradation through the end grain. Upon shipping, the ends of each board are coated with a sealer to retard against shrinkage and checking.
- C. The ends of freshly cut boards shall be treated with end sealer to reduce end checking and the potential for splitting to occur on the exposed ends.

1.5 PRODUCT DESCRIPTION

- A. Botanical Name: *Tabebuia* spp. (Lapacho group)
- B. Common Name: Ipe
- C. Other Common Names: Brazilian Walnut, Amapa, Cortez, Guayacan polvillo, Flor Amarillo, Greenheart, Madera negra, Tahuari, Lapacho negro
- D. Common Trade Names: Pau Lope, Diamond Decking, Ironwood, and many others.
- E. General Characteristics: Dark brown walnut color. Gives a green dust when cut. The texture is fine to medium. The tree may grow to 150 feet in height with trunk diameters of 6 ft. Frequently to heights of 100 ft and diameters of 2 to 3 ft. Boles are clear to 60 ft and more.
- F. Weight: Basic specific gravity (oven dry weight/green volume) 0.85 to 0.97, air dry density 66 to 75 pounds per cubic foot. A 3/4" thick finish material weights approx. 4.5 pounds per square foot.
- G. Moisture Content of Decking: Air dried to approx. 12% for use on exterior projects. (Kiln dried material is specifically for interior use, do not use kiln dried for exterior use as it will expand. Air dried inside will shrink.)
- H. Janka side hardness: 3,060 lb for green material and 3,680 lb at 12% moisture content.
- I. Bending Strength: 22,560 psi / Maximum Crushing strength: 10,350 psi
- J. STRENGTH - ASTM-D143-09 tested; Three times stronger than Cedar. Ipe Decking exceeds all existing code requirements for exterior constructions. Forest Products Laboratory toughness average for green and dry material = 404 in.-lb (5/8" specimen.) Drying and shrinkage (green to oven dry): Radial 6.6%, tangential 8.0%, volumetric 13.2%. Movement after manufacture is rated as small. Typical movement for a air dried decking board 6" wide board is 1/16" in between seasons.
- K. Working Properties: Has a blunting effect on cutters, use of carbide tipped saw blades is necessary. Routs nicely but must be predrilled for fastening.
- L. Distribution: Throughout the continental tropical America and some of the Lesser Antilles. The tree grows on a variety of sites from ridge tops to riverbanks and marsh forest. Ipe is responsible

harvested from managed forest. Ipe is as widespread in tropical America as Yellow Pine is in the United States.

- M. Durability: Heartwood is very resistant to attack by decay fungi, mold, and termites. Last 75+ years. U.S. FOREST PRODUCTS LABORATORY - Class (Very Durable - 25 years) This is the highest rating available from the forest laboratory.
- N. TERMITE RESISTANCE - U.S. NAVAL RESEARCH LABORATORY - (15 years in ground without attack by termites) Highest Rating.
- O. HARDNESS - ASTM-D143-94 tested; Approximately seven times harder than Cedar, our Ipe decking stands up to the harshest conditions imaginable.
- P. SLIP RESISTANCE - ASTM-C1028-89 tested; Our Ipe Decking exceeds the Americans with Disabilities Act requirements for Static Coefficient of friction in a wet environment
- Q. An extremely dense, tight grained wood. Generally a deep rich brown with some pieces displaying red and amber hues.
 - 1. 5/4 X 4 Ipe (1" x 3.5") is 4 ft. to 22 ft.
 - 2. 1 x 6 Ipe T&G porch Boards (1 1/16" x 5") 8 ft. to 16 ft.
- R. EB-TY Deck Fasteners for 1" Decking (5/4 deck boards) stainless screws and hidden fasteners The patented Eb-Ty hidden deck fastener system offers deck builders an easy and fast way to build hardwood decks. The system automatically sets the gap spacing between boards at 3/32" for an even and professional look (fasteners made of UV resistant polypropylene).

06 41 20 – CABINET DRAWER SLIDES**PART 4 GENERAL****4.1 SECTION INCLUDES**

- A. Drawer Slides.
- B. Turntable Slides.
- C. Keyboard Slides.
- D. Overhead Storage Door Slides.
- E. Pocket Door Slides.

4.2 RELATED SECTIONS

- A. Section 06 40 00 - Architectural Woodwork.
- B. Section 06 41 13 - Wood-Veneer-Faced Architectural Cabinets.
- C. Section 06 41 20 - Cabinet/Drawer Hardware*.
- D. Section 12 30 00 - Casework.
- E. Section 12 51 16 - Case Goods.

4.3 REFERENCES

- A. ANSI/BHMA A156.9, American National Standard for Cabinet Hardware.

4.4 DESIGN / PERFORMANCE REQUIREMENTS

- A. Slides meet or exceed the ANSI performance standards as established by BIFMA, KCMA, or BHMA.

4.5 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Submit schedule showing hardware, hardware location and finishes.
- D. Verification Samples: Two of each different item of hardware for approval by Architect. One of each pair of approved items will be returned and may be used on the project.

4.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

4.7 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.
 - 1. EXTRA MATERIALS
- B. See Section 01 60 00 - Product Requirements.
- C. Deliver extra sets of hardware items for Owner's use in maintenance.
 - 1. Drawer Slides: ____ percent of each type actually installed, but not less than 2 sets.
 - 2. Drawer Slides: ____ of each type actually installed.
 - 3. Turntable Slides: ____ percent of each type actually installed, but not less than 2 sets.
 - 4. Turntable Slides: ____ of each type actually installed.
 - 5. Cabinet Door Slides: ____ percent of each type actually installed, but not less than 2 sets.
 - 6. Cabinet Door Slides: ____ of each type actually installed.

PART 5 PRODUCTS**5.1 MANUFACTURERS**

- A. Acceptable Manufacturer: Knap & Vogt Mfg. Co., which is located at: 2700 Oak Industrial Dr. N.E. ; Grand Rapids, MI 49505-6083; Toll Free Tel: 800-253-1561; Tel: 616-459-3311; Fax: 616-459-0249; Email: [request info \(susan.hughes@kv.com\)](mailto:susan.hughes@kv.com); Web: www.kv.com
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

5.2 LIGHT DUTY DRAWER SLIDES

- A. Light Duty Drawer Slide: KV 1129; 3/4 extension; ball bearing; under drawer mounting.

1. Pound Class 35.
 2. Height: 25/64 inch (10 mm).
 3. Clearance: 1/4 inch (6 mm) under drawer.
 4. Finish: Zinc.
- B. Light Duty Drawer Slide: KV 1175; 3/4 extension; roller bearing; under drawer mounting.
1. Pound Class 50.
 2. Height: 1 inch (25 mm).
 3. Clearance: 1/8 inch (3 mm) plus 1/32 inch (0.8 mm).
 4. Finish: Zinc.
- C. Light Duty Drawer Slide: KV 1260; 3/4 extension; roller bearing; lever disconnect; side mounted.
1. Pound Class 60.
 2. Height: 3-1/8 inch (80 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Zinc.
 5. Finish: Almond.
 6. Finish: Brown.
- D. Light Duty Drawer Slide: KV 1284; 3/4 extension; roller bearing; side mounted,
1. Pound Class 75.
 2. Height: 1-9/32 inches (33 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Almond.
 5. Finish: White.
 6. Finish: Brown.
- E. Light Duty Drawer Slide: KV 1300; 3/4 extension; roller bearing; side mounted.
1. Pound Class 75.
 2. Height: 3 inches (76 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Almond.
 5. Finish: White.
 6. Finish: Zinc.
- F. Light Duty Drawer Slide: KV 1805; 3/4 extension, self close; roller bearing; side mounted.
1. Pound Class 75.
 2. Height: 1-13/32 inches (36 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Almond.
 5. Finish: White.
 6. Finish: Cream White.
- G. Light Duty Drawer Slide: KV 4400; low profile full extension; ball bearing; side mounted.
1. Pound Class 65.
 2. Height: 1-13/32 inches (35.7 mm).
 3. Side Clearance: 1/2 inch (13 mm); plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Zinc.
- H. Light Duty Drawer Slide: KV 4430 low profile full extension; push to open; ball bearing; side mounted.
1. Pound Class 65.
 2. Height: 1-13/32 inches (35.7 mm).
 3. Side Clearance: 1/2 inch (13 mm); plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Zinc.
- I. Light Duty Drawer Slide: KV 4450 low profile full extension; soft-close ball bearing; side mounted.
1. Pound Class 65.
 2. Height: 1-13/32 inches (35.7 mm).
 3. Side Clearance: 1/2 inch (13 mm); plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Zinc.
- J. Light Duty Drawer Slide: KV 6400; stainless steel, full extension; ball bearing; side mounted.
1. Pound Class 75.
 2. Material: Stainless steel, 304 grade. USDA H-1 approved.
 3. Height: 1.47/64 inches (45 mm).
 4. Side Clearance: 1/2 inch (13 mm); plus 1/32 inch (0.8 mm), minus 0 inches per side.
- K. Light Duty Drawer Slide: KV 8300; 3/4 extension; ball bearing; side mounted.
1. Pound Class 75.
 2. Height: 2 inches (51 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.

4. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
5. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- L. Light Duty Drawer Slide: MuV; full extension, soft close; roller bearings; under drawer mount.
 1. Pound Class 75.
 2. Height: 1-7/8 inches (47.4 mm).
 3. Model MuV for drawer material up to 5/8 inch (16 mm).
 4. Model MuV34 for drawer material up to 3/4 inch (19 mm).
 5. Finish: Zinc.

5.3 MEDIUM DUTY DRAWER SLIDES

- A. Medium Duty Drawer Slide: KV 8400; full extension; ball bearing; side mounted.
 1. Pound Class 100.
 2. Height: 1-3/16 inches (30 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 5. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
 6. Finish: Epoxy-coated White.
- B. Medium Duty Drawer Slide: KV 8405; overtravel; ball bearing; side mounted.
 1. Pound Class 90.
 2. 1 inch overtravel.
 3. Height: 1-3/16 inches (30 mm).
 4. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 5. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 6. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
 7. Finish: Epoxy-coated White.
- C. Medium Duty Drawer Slide: KV 8407; full extension; ball bearing; side mounted.
 1. Pound Class 100.
 2. Height: 1-3/16 inches (30 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 5. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- D. Medium Duty Drawer Slide: KV 8414; hold out, full extension; ball bearing; side mounted.
 1. Pound Class 100.
 2. Height: 1-13/16 inches (46 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
- E. Medium Duty Drawer Slide: KV 8417; self-closing; full extension; ball bearing; side mounted.
 1. Pound Class 100.
 2. Height: 1-13/16 inches (46 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 5. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- F. Medium Duty Drawer Slide: KV 8419; self-closing; overtravel; ball bearing; side mounted.
 1. Pound Class 100.
 2. 1 inch (25 mm) overtravel.
 3. Height: 1-13/16 inches (46 mm).
 4. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 5. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 6. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- G. Medium Duty Drawer Slide: KV 8430; touch release; full extension; ball bearing; side mounted.
 1. Pound Class 100.
 2. Height: 1-13/16 inches (46 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
- H. Medium Duty Drawer Slide: KV 8450FM; soft close; full extension; ball bearing; side mounted.
 1. Pound Class 100.
 2. Height: 1-13/16 inches (46 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 5. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- I. Medium Duty Drawer Slide: KV 8455FM; soft close; overtravel; ball bearing; side mounted.

1. Pound Class 90.
2. Height: 1-13/16 inches (46 mm).
3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
4. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
5. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).

5.4 HEAVY DUTY DRAWER SLIDES

- A. Heavy Duty Drawer Slide: KV 6500; full extension; ball bearing; side mounted
 1. Pound Class 120
 2. Height: 1.95 inches (49.5 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish; Zinc
- B. Heavy Duty Drawer Slide: KV 6505; over travel; ball bearing; side mounted
 1. Pound Class 120
 2. Height: 2-19/32 inches (65.9 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Zinc
- C. Heavy Duty Undermount Pull Out Drawer Slide: KV 8000; undermount; full extension; ball bearing; under drawer mounted.
 1. Pound Class 130.
 2. Height: Adjustable from 1.35/64 inches (39 mm).
 3. Clearance: Width of slide, brackets in outboard position, 2.25 inch (57 mm); Width of slide only, 3/4 inch (19 mm).
 4. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
- D. Heavy Duty File Drawer Slide: KV 8500; full extension; ball bearing; side mounted.
 1. Pound Class 150.
 2. Height: 3-51/64 inches (97 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 5. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- E. Heavy Duty File Drawer Slide: KV 8505; over travel; ball bearing; side mounted.
 1. Pound Class 150.
 2. Height: 3-51/64 inches (97 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 5. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- F. Heavy Duty File Drawer Slide: KV 8520; full extension; ball bearing; side mounted.
 1. Pound Class 175.
 2. Height: 3-51/64 inches (97 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 5. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- G. Heavy Duty File Drawer Slide: KV 8525; over travel; ball bearing; side mounted.
 1. Pound Class 175.
 2. Height: 3-51/64 inches (97 mm).
 3. Clearance: 1/2 inch (13 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 5. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- H. Heavy Duty Drawer Slide: KV 8900; full extension; ball bearing; side mounted.
 1. Pound Class 100-500 based on applications.
 2. Height: 3 inches (76 mm).
 3. Clearance: 3/4 inch (19 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 4. Finish: Zinc plated.
- I. Heavy Duty Drawer Slide: KV 8908 lock in/lock out, KV 8909 lock out, KV 8910 lock in; full extension, ball bearing; side mounted.
 1. Pound Class 180-500 based on applications.
 2. Full extension drawer slide.
 3. Height: 3 inches (76 mm).
 4. Clearance: 3/4 inch (19 mm) plus 1/32 inch (0.8 mm) minus 0 inches per side.
 5. Finish: Zinc plated.

- J. Heavy Duty Drawer Slide: MUV; full extension; under-mount.
 - 1. Pound Class 120.
 - 2. Height: 1-7/8 inches (47 mm).
 - 3. Drawer Material Thickness: 1/2 inch (13 mm) to 5/8 inch 16 mm.
 - 4. Finish: Zinc.
- K. Heavy Duty Drawer Slide: MUV34 full extension; under-mount.
 - 1. Pound Class 120.
 - 2. Height: 1-7/8 inches (47 mm).
 - 3. Drawer Material Thickness: 5/8 (16mm) to 3/4 (19 mm).
 - 4. Finish: Zinc.

5.5 TURNTABLE SLIDES

- A. Turntable Slide: KV 1388; 7/8 extension.
 - 1. Pound Class 225.
 - 2. Slide Travel 14 inches (355 mm).
 - 3. Turntable Swivel 360 degrees.
 - 4. Height: 2-1/4 inches (57 mm).
 - 5. Plate Dimensions: 16 inches (406 mm) by 16 inches (406 mm).
 - 6. Plate Diagonal Dimension: 22 inches (559 mm).
 - 7. Finish: Black.
- B. Turntable Slide: KV 1389; 7/8 extension.
 - 1. Pound Class 225.
 - 2. Slide Travel 14 inches (355 mm).
 - 3. Turntable Swivel 180 degrees.
 - 4. Height: 2-1/4 inches (57 mm).
 - 5. Plate Dimensions: 25-19/32 inches (650 mm) by 16-37/64 inches (421 mm).
 - 6. Plate Diagonal Dimension: 30-3/8 inches (559 mm).
 - 7. Finish: Black.

5.6 KEYBOARD SLIDES

- A. Keyboard/Mouse Tray: KV 5700.
 - 1. Pound Class 75.
 - 2. Keyboard Tray (5700).
 - 3. Keyboard and Mouse Tray (5710).
 - 4. Finish: Black.
 - 5. Height: Adjustable, seven positions from 2-11/32 inches (60 mm) to 3-11/16 inches (94 mm).
 - 6. Clearance: 24 inch (610 mm) wide knee space under desk or other work surface.
- B. Keyboard Slide: KV 8100; 3/4 extension; hold out; ball bearing.
 - 1. Pound Class 75.
 - 2. Mounting: Cabinet members mount to underside of desk/table top.
 - 3. Overall Drop Height: 3-1/8 inch (80 mm).
 - 4. Clearance: Total width of slide, 1-5/8 inch (41 mm) per side.
 - 5. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 - 6. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- C. Keyboard Drawer Slide: KV 8150; 3/4 extension; hold out; ball bearing.
 - 1. Pound Class 75.
 - 2. Mounting: Cabinet members mount to underside of desk/table top.
 - 3. Overall Drop Height: Adjustable in 7/32 inch (5.6 mm) increments from 2-11/32 inches (60 mm) to 3-11/16 inches (94 mm).
 - 4. Clearance: Width of slide in outboard position, 1-5/8 inch (41 mm) per side; width of slide in inboard position, 5/8 inch (16 mm) per side.
 - 5. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 - 6. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- D. Keyboard Drawer Slide: KV 8157; 3/4 extension; shelf tab; ball bearing; height adjustable.
 - 1. Pound Class 75.
 - 2. Mounting: Keyboard tray sits on shelf tabs.
 - 3. Overall Drop Height: Adjustable in 7/32 inch (5.6 mm) increments from 2-11/32 inches (60 mm) to 3-11/16 inches (94 mm).
 - 4. Clearance: Width of slide in outboard position, 1-5/8 inch (41 mm) per side; width of slide in inboard position, 5/8 inch (16 mm) per side.
 - 5. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).

6. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- E. Pencil or Center Drawer Slide: KV 8200; 3/4 extension; ball bearing.
 1. Pound Class 75.
 2. Undermount applications not requiring drawer disconnect.
 3. Overall Drop Height: 2-9/16 inch (65 mm).
 4. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 5. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- F. Pencil or Center Drawer Slide: KV 8250; 3/4 extension; ball bearing.
 1. Pound Class 75.
 2. Undermount applications not requiring drawer disconnect.
 3. Overall Drop Height: Adjustable in 7/32 inch (5.6 mm) increments from 2-11/32 inches (60 mm) to 3-11/16 inches (94 mm).
 4. Clearance: Width of slide in outboard position, 1-5/8 inch (41 mm) per side; width of slide in inboard position, 7/32 inch (5.5 mm) per side.
 5. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 6. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- G. Pencil or Center Drawer Slide: KV 8257; 3/4 extension; ball bearing.
 1. Pound Class 75.
 2. Under-mount applications not requiring drawer disconnect.
 3. Overall Drop Height: Adjustable in 7/32 inch (5.6 mm) increments from 2-11/32 inches (60 mm) to 3-11/16 inches (94 mm).
 4. Clearance: Width of slide in outboard position, 1-5/8 inch (41 mm) per side; width of slide in inboard position, 7/32 inch (5.5 mm) per side.
 5. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 6. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- H. Keyboard/Mouse/Accessory Tray: KD 100; ball bearing.
 1. Pound Class 75.
 2. Keyboard Tray.
 3. Mounting: Brackets mount in outboard position under work surface for application widths 23 inches (584 mm) or greater, or in inboard position for widths greater than 20-3/4 inches (527 mm).
 4. Finish: Black.
 5. Height: Adjustable, seven positions from 2-11/32 inches (60 mm) to 3-11/16 inches (94 mm).
- I. Keyboard/Mouse/Accessory Tray: KD 110; ball bearing.
 1. Pound Class 75.
 2. Keyboard Tray and Ambidextrous Swivel Mouse Tray.
 3. Mounting: Brackets mount in outboard position under work surface for application widths 23 inches (584 mm) or greater, or in inboard position for widths greater than 20-3/4 inches (527 mm).
 4. Finish: Black.
 5. Height: Adjustable, seven positions from 2-11/32 inches (60 mm) to 3-11/16 inches (94 mm).
- J. Keyboard/Accessory Tray: KD 1000.
 1. Pound Class 75.
 2. Mounting: Brackets mount in outboard position under work surface for application widths 29 inches (737 mm) or greater, or in inboard position for widths greater than 26-3/4 inches (679 mm).
 3. Material: trays, steel; wrist rest, Lycra Gel and PVC.
 4. Finish: Black.
 5. Height: Adjustable, seven positions from 2-11/32 inches (60 mm) to 3-11/16 inches (94 mm).
- K. Keyboard/Accessory Tray: KD 1020.
 1. Pound Class 75.
 2. Mounting: Brackets mount in outboard position under work surface for application widths 29 inches (737 mm) or greater, or in inboard position for widths greater than 26-3/4 inches (679 mm).
 3. Finish: Black.
 4. Height: Adjustable, seven positions from 2-11/32 inches (60 mm) to 3-11/16 inches (94 mm).

5.7 OVERHEAD STORAGE DOOR SLIDES

- A. Up and Over Flipper Door Slide: KV 8040.
 1. Pound Class 20.
 2. Slide Profile: 3/8 inch (10 mm).

3. Slide mounts to backside of door.
 4. Hinge mounts to underside of case top.
 5. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 6. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- B. Up and Under Flipper Door Slide: KV 8050.
1. Pound Class 20.
 2. Slide Profile: 3/8 inch (10 mm).
 3. Clearance: 1-5/16 inch (33 mm) minimum.
 4. Slide mounts to inside wall of case.
 5. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 6. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).

5.8 POCKET DOOR SLIDES

- A. Pivot Door Slide: KV 8070.
1. Pound Class 30.
 2. Maximum Door Dimensions: 48 inches (1219 mm) high by 24 inches (610 mm) wide.
 3. Slide to mount to side of case for pocket doors
 4. Follower strip mounts to back of slides.
 5. Hinges: Self closing
 6. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- B. Pivot Door Slide: KV 8080.
1. Pound Class 30.
 2. Maximum Door Dimensions: 48 inches (1219 mm) high by 24 inches (610 mm) wide.
 3. Slide to mount to side of case for pocket doors
 4. Follower strip mounts to back of slides.
 5. Hinges: Set closing
 6. Finish: Anochrome (bright zinc-chromate electro-plated with a lacquer top coat).
 7. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).
- C. Heavy Duty 4 x 4 Pocket Door Slide: KV 8090 Series; self-closing, three-way adjustable door hinge; ball bearing; pinion shaft; side mounted directly to cabinet.
1. Pound Class 75.
 2. Without pre-mounted hinge bases (8091).
 3. With pre-mounted hinge bases (8092).
 4. Maximum Door Dimensions: 72 inches (1829 mm) high by 26 inches (660 mm) wide.
 5. Size: As scheduled.
 6. Finish: Ebony Black (black zinc-chromate electro-plated with a lacquer top coat).

PART 6 EXECUTION

6.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If cabinet preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

6.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare components to receive hardware using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

6.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. After cabinets have been installed in final location, make final adjustments in cabinet hardware to assure proper alignment and smooth operation.

6.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

6.5 SCHEDULES

- A. :
- B. :

END OF SECTION

06 41 20.1 – CABINET & DRAWER HARDWARE**PART 7 GENERAL****7.1 SECTION INCLUDES**

- A. Cabinet and drawer hardware of the following types:
 - 1. Lift systems.
 - 2. Concealed hinge systems.
 - 3. Drawer runner systems.
 - 4. Box systems.
 - 5. Electronic opening systems.

7.2 RELATED SECTIONS

- A. Section 06 41 13 - Wood-Veneer-Faced Architectural Cabinets.
- B. Section 08 81 00 - Glass Glazing.
- C. Section 12 32 16 - Manufactured Plastic-Laminate-Clad Casework.
- D. Section 26 05 00 - Common Work Results for Electrical.

7.3 REFERENCES

- A. ANSI/BHMA - Meets Grade 1 - drawer runner systems. Grade 2 - hinge systems. Requirements for cycle life, static load and self-closing performance.

7.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Verification Samples: For each finish specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

7.5 QUALITY ASSURANCE

- A. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and function.
 - 1. Do not proceed with remaining work until mock-up is approved by Architect.
 - 2. Remodel mock-up area as required to produce acceptable work.

7.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

7.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

7.8 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to starting work of this section.

7.9 SEQUENCING

- A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

PART 8 PRODUCTS**8.1 MANUFACTURERS**

- A. Acceptable Manufacturer: Blum, Inc., which is located at: 7733 Old Plank Rd.; Stanley, NC 28164; Toll Free Tel: 800-438-6788; Tel: 704-827-1345; Fax: 704-827-0799; Email: request_info@blum.com; Web: www.blum.com | www.dynamicspace.us
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

8.2 LIFT SYSTEMS

- A. Approved Product: Blum AVENTOS HF bi-fold lift system
1. Cabinet Construction:
 - a. Face frame for the following application:
 - 1) Wood door.
 - 2) Wide aluminum frame door.
 - b. Frameless for the following application:
 - 1) Wood door.
 - 2) Wide aluminum frame door.
 - 3) Narrow aluminum frame door.
 2. Lift type:
 - a. Bi-fold lift mechanism
 - b. Bi-fold lift mechanism with SERVO-DRIVE: Electric opening of the door with just a light touch of the front.
 3. Cabinet Height Range:
 - a. 18-7/8 inches (479 mm) - 42 inches (1067 mm).
 4. Cabinet Width Range:
 - a. 15 inches (381 mm) - 72 inches (1828 mm).
 5. Dampening System: Self-regulates the closing speed of the door.
 - a. Integrated.
 6. Mounting:
 - a. Screw-on.
 7. Accessories:
 - a. Angle restriction clip: Part No. _____
 - b. SERVO-DRIVE: Electric opening of the door with just a light touch of the front.
- B. Approved Product: Blum AVENTOS HS up and over lift system.
1. Cabinet Construction:
 - a. Face frame for the following application:
 - 1) Wood door.
 - 2) Wide aluminum frame door.
 - b. Frameless for the following application:
 - 1) Wood door.
 - 2) Wide aluminum frame door.
 - 3) Narrow aluminum frame door.
 2. Lift type:
 - a. Up and over lift mechanism.
 - b. Up and over lift mechanism with SERVO-DRIVE: Electric opening of the door with just a light touch of the front.
 3. Cabinet Height Range:
 - a. 13-3/4 inches (350 mm) - 31-1/2 inches (800 mm).
 4. Cabinet Width Range:
 - a. 15 inches (381 mm) - 72 inches (1828 mm).
 5. Dampening System: Self-regulates the closing speed of the door.
 - a. Integrated.
 6. Mounting:
 - a. Screw-on.
 7. Accessories:
 - a. SERVO-DRIVE: Electric opening of the door with just a light touch of the front.
- C. Approved Product: Blum AVENTOS HL lift up lift system.
1. Cabinet Construction:
 - a. Face frame for the following application:
 - 1) Wood door.
 - 2) Wide aluminum frame door.
 - b. Frameless for the following application:
 - 1) Wood door.
 - 2) Wide aluminum frame door.
 - 3) Narrow aluminum frame door.
 2. Lift Type:
 - a. Lift up lift mechanism.
 - b. Lift up lift mechanism with SERVO-DRIVE: Electric opening of the door with just a light touch of the front.

3. Cabinet Height Range:
 - a. 11-13/16 inches (300 mm) - 22-13/16 inches (580 mm).
 - b. Appliance garage application: 17-11/16 inches (450 mm) - 22-13/16 inches (580 mm)
 4. Cabinet Width Range:
 - a. 15 inches (381 mm) - 72 inches (1828 mm).
 5. Dampening System: Self-regulates the closing speed of the door
 - a. Integrated.
 6. Mounting:
 - a. Screw-on.
 7. Accessories:
 - a. SERVO-DRIVE: Electric opening of the door with just a light touch of the front
- D. Approved Product: Blum AVENTOS HK stay lift system.
1. Cabinet Construction:
 - a. Face frame for the following application:
 - 1) Wood door.
 - 2) Wide aluminum frame door.
 - b. Frameless for the following application:
 - 1) Wood door.
 - 2) Wide aluminum frame door.
 - 3) Narrow aluminum frame door.
 2. Lift Type:
 - a. Stay lift mechanism.
 - b. Stay lift mechanism with SERVO-DRIVE: Electric opening of the door with just a light touch of the front.
 - c. Stay lift mechanism with TIP-ON: Mechanical opening of the door with just a light touch of the front
 3. Cabinet Height Range:
 - a. 11-13/16 inches (300 mm) - 24 inches (610 mm).
 4. Cabinet Width Range:
 - a. 15 inches (381 mm) - 72 inches (1828 mm).
 5. Dampening System: Self-regulates the closing speed of the door
 - a. Integrated.
 6. Mounting:
 - a. Screw-on.
 7. Accessories:
 - a. Angle restriction clip: Part No. _____
 - b. SERVO-DRIVE: Electric opening of the door with just a light touch of the front
 - c. TIP-ON: Mechanical opening of the door with just a light touch of the front
- E. Approved Product: Blum AVENTOS HK-S stay lift system
1. Cabinet Construction:
 - a. Face frame for the following application:
 - 1) Wood door.
 - 2) Wide aluminum frame door.
 - b. Frameless for the following application:
 - 1) Wood door.
 - 2) Wide aluminum frame door.
 - 3) Narrow aluminum frame door.
 2. Lift Type:
 - a. Stay lift mechanism.
 - b. Stay lift mechanism with TIP-ON: Mechanical opening of the door with just a light touch of the front.
 3. Cabinet Height Range:
 - a. 7-3/8 inches (186 mm) - 24 inches (610 mm).
 4. Cabinet Width Range:
 - a. 15 inches (381 mm) - 72 inches (1828 mm).
 5. Dampening System: Self-regulates the closing speed of the door
 - a. Integrated.
 6. Mounting:
 - a. Screw-on.
 7. Accessories:

- a. Angle restriction clip: Part No. _____
- b. TIP-ON: Mechanical opening of the door with just a light touch of the front

F. Approved Product: Blum AVENTOS HK-XS smaller stay lift system

1. Cabinet Construction:
 - a. Face frame for the following application:
 - 1) Wood door.
 - 2) Wide aluminum frame door.
 - b. Frameless for the following application:
 - 1) Wood door.
 - 2) Wide aluminum frame door.
 - 3) Narrow aluminum frame door.
2. Lift Type:
 - a. Smaller stay lift mechanism.
 - b. Stay lift mechanism with TIP-ON: Mechanical opening of the door with just a light touch of the front
3. Cabinet Height Range:
 - a. 9-3/8 inches (238 mm) - 24 inches (610 mm).
4. Cabinet Width Range:
 - a. 9 inches (229 mm) - 72 inches (1828 mm).
5. Dampening System: Self-regulates the closing speed of the door
 - a. Integrated.
6. Mounting:
 - a. Screw-on.
7. Accessories:
 - a. Angle restriction clip: Part No. _____.
 - b. TIP-ON: Mechanical opening of the door with just a light touch of the front

8.3 CONCEALED HINGE SYSTEMS

A. Approved Product: Blum CLIP top Angled Hinges

1. Cabinet Construction:
 - a. Frameless for the following application:
 - 1) Full overlay.
 - 2) Partial overlay.
 - 3) Corner merge.
 - 4) Inset.
 - 5) Mitered corner.
2. Hinge Type:
 - a. Angled hinge.
3. Angle:
 - a. Plus 15 degree.
 - b. Plus 20 degree.
 - c. Plus 30 degree II.
 - d. Plus 30 degree III.
 - e. Plus 45 degree I.
 - f. Plus 45 degree II.
 - g. Plus 45 degree III.
 - h. Minus 15 degree.
 - i. Minus 30 degree.
 - j. Minus 45 degree.
 - k. 95 degree: Straight-arm.
 - l. 95 degree: Half-cranked.
 - m. 95 degree: Full-cranked.
4. Suitable for Door Type:
 - a. For 19 mm (3/4 inch) door thickness, material consist of wood, melamine, MDF or particleboard.
5. Closing:
 - a. Self-close.
6. Dampening System: Self-regulates the closing speed of the hinge
 - a. Approved Product: BLUMOTION 970A.
7. Mounting:

- a. INSERTA, tool-free assembly.
 8. Hinges per Door:
 - a. 2 hinges for doors less than 36 inches (914 mm) high and less than 15 lb (7 kg).
 - b. 3 hinges for doors less than 64 inches (1626 mm) high and less than 30 lb (14 kg).
 - c. 4 hinges for doors less than 86 inches (2184 mm) high and less than 45 lb (20 kg).
 - d. 5 hinges for doors less than 96 inches (2438 mm) high and less than 60 lb (27 kg).
 - e. The distance between the top and bottom hinge must be greater than the width of the door.
 9. Cover Caps:
 - a. Nickel plated steel.
 - b. Nickel plated steel with Blum logo (embossed).
 - c. Nickel plated steel with custom logo (minimums apply).
- B. Approved Product: Blum CLIP top BLUMOTION Angled Hinges.
1. Cabinet Construction:
 - a. Frameless for the following application:
 - 1) Full overlay
 - 2) Partial overlay
 - 3) Corner merge
 - 4) Inset
 - 5) Mitered corner
 2. Hinge Type:
 - a. Angled hinge.
 3. Angle:
 - a. Plus 15 degree.
 - b. Plus 20 degree.
 - c. Plus 30 degree II.
 - d. Plus 30 degree III.
 - e. Plus 45 degree I.
 - f. Plus 45 degree II.
 - g. Plus 45 degree III.
 - h. Minus 15 degree.
 - i. Minus 30 degree.
 - j. Minus 45 degree.
 - k. 95 degree: Straight-arm.
 - l. 95 degree: Half-cranked.
 - m. 95 degree: Full-cranked.
 4. Suitable for Door Type:
 - a. For 19 mm (3/4 inch) door thickness, material consist of wood, melamine, MDF or particleboard.
 5. Closing:
 - a. Soft close.
 6. Dampening System: Self-regulates the closing speed of the hinge
 - a. Integrated into hinge.
 7. Mounting:
 - a. INSERTA, tool-free assembly.
 8. Hinges per Door:
 - a. 2 hinges for doors less than 36 inches (914 mm) high and less than 15 lb (7 kg).
 - b. 3 hinges for doors less than 64 inches (1626 mm) high and less than 30 lb (14 kg).
 - c. 4 hinges for doors less than 86 inches (2184 mm) high and less than 45 lb (20 kg).
 - d. 5 hinges for doors less than 96 inches (2438 mm) high and less than 60 lb (27 kg).
 - e. The distance between the top and bottom hinge must be greater than the width of the door.
 9. Cover Caps:
 - a. Nickel plated steel.
 - b. Nickel plated steel with Blum logo (embossed).
 - c. Nickel plated steel with custom logo (minimums apply).
- C. Approved Product: Blum CLIP top Concealed Hinges.
1. Cabinet Construction:
 - a. Face frame for the following application:
 - 1) Full overlay.
 - 2) Partial overlay.

- 3) Twin overlay.
- 4) Inset.
- 5) Inset and overlay corner.
- 6) Flush door.
- b. Frameless for the following application:
 - 1) Full overlay.
 - 2) Partial overlay.
 - 3) Twin overlay.
 - 4) Inset.
 - 5) Inset and overlay corner.
 - 6) Flush door.
2. Hinge Type:
 - a. Straight-arm.
 - b. Half-cranked.
 - c. Full-cranked.
 - d. Thick door.
 - e. Wide angled.
 - f. Zero protrusion.
 - g. Inset blind corner.
 - h. Overlay blind corner.
 - i. Aluminum door.
 - j. Diagonal 45 degree.
 - k. Mini.
 - l. Glass.
 - m. Bi-fold.
 - n. Angled.
 - o. Special applications.
3. Angle:
 - a. 107 degree.
 - b. 110 degree.
 - c. 110 plus degree.
 - d. 120 degree.
 - e. 120 plus degree.
 - f. 95 degree thick door.
 - g. 170 degree.
 - h. 170 degree special applications.
 - i. 155 degree zero protrusion.
 - j. 155 degree special applications.
 - k. 125 degree zero protrusion.
 - l. 125 degree special applications.
 - m. 95 degree inset blind corner.
 - n. 95 degree overlay blind corner.
 - o. 120 degree aluminum door for BLUMOTION.
 - p. 120 degree aluminum door.
 - q. 110 degree diagonal 45 degree.
 - r. 95 degree mini.
 - s. 95 degree glass door.
 - t. 60 degree bi-fold.
 - u. 95 degree / 110 degree angled.
4. Suitable for Door Type:
 - a. For door thickness range 16 mm to 30 mm, material consist of wood, melamine, MDF or particleboard.
5. Closing:
 - a. Self-close.
 - b. Free swing.
6. Dampening System: Self-regulates the closing speed of the hinge.
 - a. Approved Product: BLUMOTION 973A.
 - b. Approved Product: BLUMOTION 971A.
 - c. Approved Product: BLUMOTION 970A.
7. Mounting:
 - a. Screw-on.

- b. Press-in.
 - c. INSERTA, tool-free assembly.
 - d. EXPANDO.
8. Hinges per Door:
- a. 2 hinges for doors less than 36 inches (914 mm) high and less than 15 lb (7 kg).
 - b. 3 hinges for doors less than 64 inches (1626 mm) high and less than 30 lb (14 kg).
 - c. 4 hinges for doors less than 86 inches (2184 mm) high and less than 45 lb (20 kg).
 - d. 5 hinges for doors less than 96 inches (2438 mm) high and less than 60 lb (27 kg).
 - e. The distance between the top and bottom hinge must be greater than the width of the door.
9. Cover Caps:
- a. Nylon: Black.
 - b. Nylon: Black with custom logo (minimums apply).
 - c. Nylon: White.
 - d. Nylon: White with custom logo (minimums apply).
 - e. Nickel plated steel.
 - f. Nickel plated steel with Blum logo (embossed).
 - g. Nickel plated steel with custom logo (minimums apply).
- D. Approved Product: Blum CLIP top BLUMOTION Hinges. Concealed hinges with integrated soft close.
1. Cabinet Construction:
- a. Face frame for the following application:
 - 1) Full overlay.
 - 2) Partial overlay.
 - 3) Twin overlay.
 - 4) Inset.
 - 5) Inset and overlay corner.
 - 6) Flush door.
 - b. Frameless for the following application:
 - 1) Full overlay.
 - 2) Partial overlay.
 - 3) Twin overlay.
 - 4) Inset.
 - 5) Inset and overlay corner.
 - 6) Flush door.
2. Hinge Type:
- a. Straight-arm.
 - b. Half-cranked.
 - c. Full-cranked.
 - d. Thick door.
 - e. Diagonal 45 degree.
 - f. Inset blind corner.
 - g. Overlay blind corner.
 - h. Narrow aluminum door.
 - i. Angled
3. Angle:
- a. 110 degree.
 - b. 110 plus degree.
 - c. 95 degree thick door.
 - d. 110 degree diagonal 45 degree.
 - e. 95 degree inset blind corner.
 - f. 95 degree overlay blind corner.
 - g. 95 degree narrow aluminum door.
4. Suitable for Door Type:
- a. For door thickness range 16 mm to 30 mm, material consist of wood, melamine, MDF or particleboard.
5. Closing:
- a. Soft close.
6. Dampening System: Self-regulates the closing speed of the hinge
- a. Integrated into hinge.
7. Mounting:
- a. Screw-on.

- b. Press-in.
 - c. INSERTA, tool-free assembly.
 - d. EXPANDO.
8. Hinges per Door:
- a. 2 hinges for doors less than 36 inches (914 mm) high and less than 15 lb (7 kg).
 - b. 3 hinges for doors less than 64 inches (1626 mm) high and less than 30 lb (14 kg).
 - c. 4 hinges for doors less than 86 inches (2184 mm) high and less than 45 lb (20 kg).
 - d. 5 hinges for doors less than 96 inches (2438 mm) high and less than 60 lb (27 kg).
 - e. The distance between the top and bottom hinge must be greater than the width of the door
9. Cover Caps:
- a. Nylon: Black.
 - b. Nylon: Black with custom logo (minimums apply).
 - c. Nylon: White.
 - d. Nylon: White with custom logo (minimums apply).
 - e. Nickel plated steel.
 - f. Nickel plated steel with Blum logo (embossed).
 - g. Nickel plated steel with custom logo (minimums apply).
- E. Approved Product: Blum CLIP top Glass Door Hinges.
1. Cabinet Construction:
- a. Frameless for the following application:
 - 1) Full overlay.
 - 2) Partial overlay.
 - 3) Inset.
2. Hinge Type:
- a. Straight-arm.
 - b. Half-cranked.
 - c. Full-cranked.
3. Angle:
- a. 95 degree: Straight-arm.
 - b. 95 degree: Half-cranked.
 - c. 95 degree: Full-cranked.
4. Suitable for Door Type:
- a. For glass thickness of 4.5 mm to 7 mm.
5. Closing:
- a. Self-close.
6. Dampening System: Self-regulates the closing speed of the hinge
- a. Approved Product: BLUMOTION 971A.
 - b. Approved Product: BLUMOTION 970A.
7. Mounting: Screw-on.
8. Hinges per Door:
- a. 2 hinges for doors less than 36 inches (914 mm) high and less than 15 lb (7 kg).
 - b. 3 hinges for doors less than 64 inches (1626 mm) high and less than 30 lb (14 kg).
 - c. 4 hinges for doors less than 86 inches (2184 mm) high and less than 45 lb (20 kg).
 - d. 5 hinges for doors less than 96 inches (2438 mm) high and less than 60 lb (27 kg).
 - e. The distance between the top and bottom hinge must be greater than the width of the door.
9. Cover Caps:
- a. D-shaped in polished chrome for door.
 - b. Round in polished chrome for door.
 - c. Round in black for door.
 - d. Nickel plated steel.
 - e. Nickel plated steel with Blum logo (embossed).
 - f. Nickel plated steel with custom logo (minimums apply).
- F. Approved Product: Blum CLIP top 120 Degree Aluminum Door Hinges.
1. Cabinet Construction:
- a. Frameless for the following application:
 - 1) Full overlay
2. Hinge Type:
- a. Straight-arm.
3. Angle:

- a. 95 degree: Straight-arm.
 4. Suitable for Door Type:
 - a. For aluminum door thickness 18 mm to 22 mm
 5. Closing:
 - a. Self-close.
 6. Dampening System: Self-regulates the closing speed of the hinge.
 - a. Approved Product: BLUMOTION 973A.
 7. Mounting:
 - a. Screw-on.
 8. Hinges per Door:
 - a. 2 hinges for doors less than 36 inches (914 mm) high and less than 15 lb (7 kg).
 - b. 3 hinges for doors less than 64 inches (1626 mm) high and less than 30 lb (14 kg).
 - c. 4 hinges for doors less than 86 inches (2184 mm) high and less than 45 lb (20 kg).
 - d. 5 hinges for doors less than 96 inches (2438 mm) high and less than 60 lb (27 kg).
 - e. The distance between the top and bottom hinge must be greater than the width of the door.
 9. Cover Caps:
 - a. Nylon: Black.
 - b. Nylon: Black with custom logo (minimums apply).
 - c. Nylon: White.
 - d. Nylon: White with custom logo (minimums apply).
 - e. Nickel plated steel.
 - f. Nickel plated steel with Blum logo (embossed).
 - g. Nickel plated steel with custom logo (minimums apply).
- G. Approved Product: Blum CLIP Hinges
1. Cabinet Construction:
 - a. Face frame for the following application:
 - 1) Full overlay.
 - 2) Partial overlay.
 - 3) Twin overlay.
 - 4) Inset
 - b. Frameless for the following application:
 - 1) Full overlay.
 - 2) Partial overlay.
 - 3) Twin overlay.
 - 4) Inset.
 2. Hinge Type:
 - a. Straight-arm.
 - b. Half-cranked.
 - c. Full-cranked.
 3. Angle:
 - a. 107 degree.
 - b. 100 degree.
 4. Suitable for Door Type:
 - a. For door thickness 16 mm to 24 mm, material consist of wood, melamine, MDF or particleboard.
 5. Closing:
 - a. Self-close.
 - b. Free swing.
 6. Dampening System: Self-regulates the closing speed of the hinge
 - a. Approved Product: BLUMOTION 973A.
 - b. Approved Product: BLUMOTION 971A.
 - c. Approved Product: BLUMOTION 970A.
 7. Mounting:
 - a. Screw-on.
 - b. Press-in.
 - c. INSERTA, tool-free assembly.
 8. Hinges per Door:
 - a. 2 hinges for doors less than 36 inches (914 mm) high and less than 15 lb (7 kg).
 - b. 3 hinges for doors less than 64 inches (1626 mm) high and less than 30 lb (14 kg).
 - c. 4 hinges for doors less than 86 inches (2184 mm) high and less than 45 lb (20 kg).

- d. 5 hinges for doors less than 96 inches (2438 mm) high and less than 60 lb (27 kg).
 - e. The distance between the top and bottom hinge must be greater than the width of the door.
9. Cover Caps:
- a. Nylon: Black.
 - b. Nylon: Black with custom logo (minimums apply).
 - c. Nylon: White.
 - d. Nylon: White with custom logo (minimums apply).
 - e. Nickel plated steel.
 - f. Nickel plated steel with Blum logo (embossed).
 - g. Nickel plated steel with custom logo (minimums apply).
- H. Approved Product: Blum COMPACT Concealed Hinges.
1. Cabinet Construction:
- a. Face frame for the following application:
 - 1) 1/4 inch (6.35 mm) overlay.
 - 2) 3/8 inch (9.5 mm) overlay.
 - 3) 1/2 inch (12.7 mm) overlay.
 - 4) 5/8 inch (15.9) overlay.
 - 5) 3/4 inch (19 mm) overlay.
 - 6) 1 inch (25.4 mm) overlay.
 - 7) 1-1/8 inches (27.6 mm) overlay.
 - 8) 1-1/4 inches (31.8 mm) overlay.
 - 9) 1-5/16 inches (33 mm) overlay.
 - 10) 1-3/8 inches (35 mm) overlay.
 - 11) 1-1/2 inches (38 mm) overlay.
 - 12) 1-9/16 inches (39.7 mm) overlay.
 - 13) 1-5/8 inches (41.2 mm) overlay.
 - 14) 1-3/8 inches (41.2 mm) plus overlay face mount.
2. Hinge Type:
- a. One piece.
 - b. Two piece.
 - c. Wraparound.
 - d. Edge mount.
 - e. Face mount.
3. Angle:
- a. 105 degree.
 - b. 107 degree.
 - c. 110 degree.
4. Suitable for Door Type:
- a. For door thickness 16 mm to 19 mm, material consist of wood, melamine, MDF or particleboard.
5. Closing:
- a. Self-close.
6. Dampening System: Self-regulates the closing speed of the hinge
- a. Approved Product: BLUMOTION 971A.
7. Mounting:
- a. Screw-on.
 - b. Press-in.
8. Hinges per Door:
- a. 2 hinges for doors less than 36 inches (914 mm) high and less than 15 lb (7 kg).
 - b. 3 hinges for doors less than 64 inches (1626 mm) high and less than 30 lb (14 kg).
 - c. 4 hinges for doors less than 86 inches (2184 mm) high and less than 45 lb (20 kg).
 - d. 5 hinges for doors less than 96 inches (2438 mm) high and less than 60 lb (27 kg).
 - e. The distance between the top and bottom hinge must be greater than the width of the door.
9. Cover Caps:
- a. Nickel plated steel.
 - b. Nickel plated steel with Blum logo (embossed).
 - c. Nickel plated steel with custom logo (minimums apply).
- I. Approved Product: Blum COMPACT BLUMOTION Concealed Hinges.
1. Cabinet Construction:

- a. Face frame for the following application:
 - 1) 5/16 inch (7.9 mm) overlay.
 - 2) 3/8 inch (9.5 mm) overlay.
 - 3) 1/2 inch (12.7 mm) overlay.
 - 4) 5/8 inch (15.9) overlay.
 - 5) 3/4 inch (19 mm) overlay.
 - 6) 1 inch (25.4 mm) overlay.
 - 7) 1-1/4 inches (31.8 mm) overlay.
 - 8) 1-5/16 inches (33 mm) overlay.
 - 9) 1-3/8 inches (35 mm) overlay.
 - 10) 1-1/2 inches (38 mm) overlay.
 - 11) 1-9/16 inches (39.7 mm) overlay.
 - 12) 1-3/8 inches (41.2 mm) plus overlay face mount.
2. Hinge Type:
 - a. One piece.
 - b. Wraparound.
 - c. Edge mount.
 - d. Face mount.
3. Angle:
 - a. 105 degree.
 - b. 107 degree.
 - c. 110 degree.
4. Suitable for Door Type:
 - a. For door thickness 16 mm to 19 mm, material consist of wood, melamine, MDF or particleboard.
5. Closing:
 - a. Soft close.
6. Dampening System: Self-regulates the closing speed of the hinge
 - a. Integrated into hinge.
7. Mounting:
 - a. Screw-on.
 - b. Press-in.
8. Hinges per Door:
 - a. 2 hinges for doors less than 36 inches (914 mm) high and less than 15 lb (7 kg).
 - b. 3 hinges for doors less than 64 inches (1626 mm) high and less than 30 lb (14 kg).
 - c. 4 hinges for doors less than 86 inches (2184 mm) high and less than 45 lb (20 kg).
 - d. 5 hinges for doors less than 96 inches (2438 mm) high and less than 60 lb (27 kg).
 - e. The distance between the top and bottom hinge must be greater than the width of the door.
9. Cover Caps:
 - a. Nickel plated steel.
 - b. Nickel plated steel with Blum logo (embossed).
 - c. Nickel plated steel with custom logo (minimums apply).

8.4 DRAWER RUNNER SYSTEMS

- A. Approved Product: Blum TANDEM Concealed Runners for Wood Drawers.
 1. Cabinet Construction:
 - a. Face frame for the following application:
 - 1) Full overlay.
 - 2) Inset.
 - 3) Narrow.
 - 4) Interior roll-out/shelf/tray.
 - 5) Bottom mount.
 - 6) SPACE CORNER - 90 degree corner cabinet with drawers.
 - 7) Deep.
 - b. Frameless for the following application:
 - 1) Full overlay.
 - 2) Inset.
 - 3) Narrow.
 - 4) Interior roll-out/shelf/tray.
 - 5) Bottom mount.

- 6) SPACE CORNER - 90 degree corner cabinet with drawers.
- 7) Deep.
- 2. Runner Type:
 - a. Full extension.
 - b. Full extension with BLUMOTION.
 - c. Heavy duty full extension with BLUMOTION.
 - d. Bottom mount heavy duty with BLUMOTION.
- 3. Drawer Length:
 - a. 9 inches (229 mm).
 - b. 12 inches (305 mm).
 - c. 15 inches (381 mm).
 - d. 18 inches (457 mm).
 - e. 21 inches (533 mm).
 - f. 24 inches (610 mm).
 - g. 27 inches (686 mm).
 - h. 30 inches (762 mm).
- 4. Drawer Side Thickness:
 - a. Up to 5/8 inch (16 mm).
 - b. Up to 3/4 inch (19 mm).
- 5. Drawer Weight Capacity:
 - a. 75 pounds dynamic/100 pounds static.
 - b. 90 pounds dynamic/100 pounds static.
 - c. 135 pounds dynamic/150 pounds static.
- 6. Locking Device: One right and one left required per drawer.
 - a. With side-to-side adjustment:
 - 1) Standard.
 - 2) Vertical mount.
 - 3) Depth adjustable.
 - b. Without side-to-side adjustment:
 - 1) Standard.
 - 2) Vertical mount.
 - 3) Narrow drawer.
- 7. Materials/Finish:
 - a. Runners: Zinc-coated steel with nylon rollers
 - b. Rear brackets/sockets: Zinc-coated steel or nylon
 - c. Locking devices: Stamped steel, zinc die-cast or nylon
 - d. End caps: Nylon
 - e. Bottom/Back/Side spacers: Nylon
- 8. Closing:
 - a. Self-close.
- 9. Dampening System: Self-regulates the closing speed of the drawer.
 - a. Integrated into 563 & 569 drawer runners.
- 10. Mounting:
 - a. Screw-on: side mount or block out.
 - b. Screw-on: frame mount with rear bracket.
 - c. Screw-on: bottom mount.
- 11. Accessories:
 - a. ORGA-LINE:
 - 1) Flatware set: Part No. _____
 - 2) Flatware tray: Part No. _____
 - 3) Utensil set: Part No. _____
 - 4) 4.) Plate holder: Part No. _____
 - 5) Spice trays: Part No. _____
 - 6) Knife holder: Part No. _____
 - 7) Deep drawer cross divider: Part No. _____
 - b. SERVO-DRIVE: Electric opening of the drawer with just a light touch of the front.
 - c. TIP-ON: Mechanical opening of the drawer with just a light touch of the front.

B. Approved Product: Blum STANDARD Drawer Runners for Wood Drawers.

- 1. Cabinet Construction:
 - a. Face frame for the following application:

- 1) Full overlay.
- 2) Bottom mount.
- 3) Deep.
- b. Frameless for the following application:
 - 1) Full overlay.
 - 2) Bottom mount.
 - 3) Deep.
2. Runner Type:
 - a. Partial extension.
 - b. Full extension.
3. Drawer Length:
 - a. 10 inches (250 mm).
 - b. 12 inches (300 mm).
 - c. 14 inches (350 mm).
 - d. 16 inches (400 mm).
 - e. 18 inches (450 mm).
 - f. 20 inches (500 mm).
 - g. 22 inches (550 mm).
 - h. 24 inches (600 mm).
 - i. 26 inches (650 mm).
 - j. 28 inches (700 mm).
 - k. 30 inches (753 mm).
 - l. 32 inches (803 mm).
4. Drawer Weight Capacity:
 - a. 75 pounds dynamic/100 pounds static.
5. Materials/Finish:
 - a. Cream epoxy coated steel.
6. Closing:
 - a. Self-close.
7. Mounting:
 - a. Screw-on: side mount or block out.
 - b. Screw-on: frame mount with rear bracket.
 - c. Screw-on: bottom mount.

8.5 BOX SYSTEMS

- A. Approved Product: Blum LEGRABOX Premium Metal Drawer System
 1. Cabinet Construction:
 - a. Frameless for the following application:
 - 1) Standard drawer.
 - 2) Pantry.
 - 3) Sink.
 - 4) Deep drawer.
 2. Runner Type:
 - a. Full extension with BLUMOTION.
 - b. Heavy duty full extension with BLUMOTION.
 3. Drawer Length:
 - a. 11 inches (270 mm).
 - b. 14 inches (350 mm).
 - c. 16 inches (400 mm).
 - d. 18 inches (450 mm).
 - e. 20 inches (500 mm).
 - f. 22 inches (550 mm).
 - g. 24 inches (600 mm).
 4. Drawer Height:
 - a. LEGRABOX M: 3-9/16 inches (90.5 mm).
 - b. LEGRABOX C: 7 inches (177 mm).
 - c. LEGRABOX F: 9-1/2 inches (241 mm).
 5. Drawer Side Thickness:
 - a. 1/2 inch (12.8 mm).
 6. Drawer Weight Capacity:

- a. 88 pounds dynamic/100 pounds static.
- b. 155 pounds dynamic/175 pounds static.
- 7. Materials/Finish:
 - a. Orion gray.
 - b. Brushed stainless steel.
- 8. Closing:
 - a. Self-close.
- 9. Dampening System: Self-regulates the closing speed of the drawer
 - a. Integrated.
- 10. Accessories:
 - a. AMBIA-LINE
 - 1) Flatware set: Part No. _____
 - 2) Utensil set: Part No. _____
 - 3) Plate holder: Part No. _____
 - 4) Spice trays: Part No. _____
 - 5) Knife holder: Part No. _____
 - 6) Deep drawer frame: Part No. _____
 - 7) Deep drawer adapter plate: Part No. _____
 - b. SERVO-DRIVE: Electric opening of the drawer with just a light touch of the front.
 - c. TIP-ON: Mechanical opening of the drawer with just a light touch of the front
 - d. Cover Caps - outside:
 - 1) Orion gray.
 - 2) Nickel.
 - e. Cover Caps - inside:
 - 1) Orion gray.
 - 2) Nickel.
 - f. Lateral stabilizer set.

B. Approved Product: Blum TANDEMBOX Deluxe Metal Drawer System

- 1. Cabinet Construction:
 - a. Frameless for the following application:
 - 1) Standard drawer.
 - 2) Pantry.
 - 3) File.
 - b. Waste/recycle.
 - c. Sink.
 - d. SPACE CORNER - 90 degree corner cabinet with drawers 7.) Deep drawer.
- 2. Runner Type:
 - a. Full extension with BLUMOTION.
 - b. Heavy duty full extension with BLUMOTION.
 - c. Bottom mount heavy duty with BLUMOTION.
- 3. Drawer Length:
 - a. 11 inches (270 mm).
 - b. 14 inches (350 mm).
 - c. 16 inches (400 mm).
 - d. 18 inches (450 mm).
 - e. 20 inches (500 mm).
 - f. 22 inches (550 mm).
 - g. 24 inches (600 mm).
 - h. 26 inches (650 mm).
- 4. Drawer Height:
 - a. TANDEMBOX N: 2-11/16 inches (69 mm).
 - b. TANDEMBOX M: 3-5/16 inches (84 mm).
 - c. TANDEMBOX B: 5-3/4 inches (146 mm).
 - d. TANDEMBOX D: 8-1/8 inches (207 mm).
- 5. Drawer Side Thickness:
 - a. 19/32 inch (15 mm).
- 6. Drawer Weight Capacity:
 - a. 75 pounds dynamic/100 pounds static.
 - b. 150 pounds dynamic/175 pounds static.
- 7. Materials/Finish:

- a. Gray.
- b. Stainless steel.
- c. Silk white (waste/recycle set only).
- 8. Closing:
 - a. Self-close.
- 9. Dampening System: Self-regulates the closing speed of the drawer
 - a. Integrated.
- 10. Accessories:
 - a. ORGA-LINE:
 - 1) Flatware set: Part No. _____
 - 2) Flatware tray: Part No. _____
 - 3) Utensil set: Part No. _____
 - 4) Plate holder: Part No. _____
 - 5) Spice trays: Part No. _____
 - 6) Knife holder: Part No. _____
 - 7) Deep drawer cross divider: Part No. _____
 - 8) Deep drawer cross gallery rail: Part No. _____
 - b. SERVO-DRIVE: Electric opening of the drawer with just a light touch of the front
 - c. TIP-ON: Mechanical opening of the drawer with just a light touch of the front

C. Approved Product: Blum METABOX Versatile Metal Drawer System

- 1. Cabinet Construction:
 - a. Face frame for the following application:
 - 1) Standard drawer.
 - 2) Pantry.
 - 3) File.
 - 4) Deep drawer.
 - b. Frameless for the following application:
 - 1) Standard drawer.
 - 2) Pantry.
 - 3) File.
 - 4) Deep drawer.
- 2. Runner Type:
 - a. 320 Series: 3/4 extension.
 - b. 320 Series: 3/4 extension with BLUMOTION (add-on).
 - c. 330 Series: Full extension with 3/4 inch (18 mm) over extension.
- 3. Drawer Length:
 - a. 11 inches (270 mm).
 - b. 14 inches (350 mm).
 - c. 16 inches (400 mm).
 - d. 18 inches (450 mm).
 - e. 20 inches (500 mm).
 - f. 22 inches (550 mm).
- 4. Drawer Height:
 - a. METABOX N: 2-1/8 inches (54 mm).
 - b. METABOX M: 3-3/8 inches (86 mm).
 - c. METABOX K: 4-5/8 inches (118 mm).
 - d. METABOX H: 5-7/8 inches (150 mm).
- 5. Drawer Side Thickness:
 - a. 1/16 inch (1.5 mm).
- 6. Drawer Weight Capacity:
 - a. 75 pounds dynamic/100 pounds static.
- 7. Materials/Finish:
 - a. White epoxy coated.
- 8. Closing:
 - a. Self-close.
- 9. Dampening System: Self-regulates the closing speed of the drawer
 - a. 320 Series: BLUMOTION add-on Z70.0320.
- 10. Accessories:
 - a. Organization:
 - 1) INSERTA (tool free) gallery set: Part No. _____

- 2) BOXSIDE (2 required): Part No. _____
- 3) Cross gallery rail: Part No. _____
- 4) Cross gallery connectors (2 required): Part No. _____

- b. File drawer set: Part No. _____
- c. Cover Caps:
 - 1) Nylon: White.
- d. SERVO-DRIVE: Electric opening of the drawer with just a light touch of the front
- e. TIP-ON: Mechanical opening of the drawer with just a light touch of the front.

8.6 ELECTRONIC OPENING SYSTEMS

- A. Approved Product: Blum vertical aluminum profile for TANDEM.
 - 1. Vertical Aluminum Profile:
 - a. Part number: Z10T720AB - Profile with cable, length 28-3/8 inches (720 mm).
 - b. Part number: Z10T1170A - Profile without cable, length 46 inches (1170 mm).
 - 2. Top And Bottom Adapter Set:
 - a. Part number: Z10D01E0.01 - For use with horizontal stretcher rail.
 - 3. Back And Bottom Adapter Set:
 - a. Part number: Z10D01EA.01 - For use with back stretcher rail.
 - 4. Drive Unit:
 - a. Part number: Z10A3000.02.
 - 5. Distance Bumper:
 - a. Part number: 933.0531 - 5 mm diameter bumper.
 - b. Part number: 933.1220 - Screw-on bumper.
 - 6. Power Supply Set:
 - a. Part number: Z10NE02UG10.
- B. Approved Product: Blum inset vertical aluminum profile for TANDEM.
 - 1. Inset Vertical Aluminum Profile:
 - a. Part number: Z10T720AB - Profile with cable, length 28-3/8 inches (720 mm).
 - b. Part number: Z10T1170A - Profile without cable, length 46 inches (1170 mm).
 - 2. Top And Bottom Adapter Set:
 - a. Part number: Z10D01E0.01 - For use with horizontal stretcher rail.
 - 3. Drive Unit:
 - a. Part number: Z10A3000.02.
 - 4. Locking Device With Integrated Distance Bumper (Both Required):
 - a. Part number: T51.1901.PS L.
 - b. Part number: T51.1901.PS R.
 - 5. Power Supply Set:
 - a. Part number: Z10NE02UG10.
- C. Approved Product: Blum horizontal aluminum profile for TANDEM.
 - 1. Horizontal Aluminum Profile:
 - a. Part number: Z10T1143B - Profile length 45 inches (1143 mm).
 - 2. Adapter Set:
 - a. Part number: Z10D5800.US.
 - 3. Drive Unit:
 - a. Part number: Z10A3000.02.
 - 4. Distance Bumper:
 - a. Part number: 933.0531 - 5 mm diameter bumper.
 - b. Part number: 933.1220 - Screw-on bumper.
 - 5. Power Supply Set:
 - a. Part number: Z10NE02UG10.
- D. Approved Product: Blum inset horizontal aluminum profile for TANDEM.
 - 1. Inset Horizontal Aluminum Profile:
 - a. Part number: Z10T1143B - Profile length 45 inches (1143 mm).
 - 2. Adapter Set:
 - a. Part number: Z10D5800.US.
 - 3. Drive Unit:
 - a. Part number: Z10A3000.02.
 - 4. Locking Device With Integrated Distance Bumper (Both Required):

- a. Part number: T51.1901.PS L.
- b. Part number: T51.1901.PS R.
5. Power Supply Set:
 - a. Part number: Z10NE02UG10.

- E. Approved Product: Blum top bracket for TANDEM.
 1. Top Bracket With Adapter:
 - a. Part number: Z10D6252.
 2. Drive Unit:
 - a. Part number: Z10A3000.02.
 3. Distance Bumper:
 - a. Part number: 933.0531 - 5 mm diameter bumper.
 - b. Part number: 933.1220 - Screw-on bumper.
 4. Power Supply Set:
 - a. Part number: Z10NE02UG10.

- F. Approved Product: Blum inset top bracket for TANDEM.
 1. Top Bracket With Adapter:
 - a. Part number: Z10D6252.
 2. Drive Unit:
 - a. Part number: Z10A3000.02.
 3. Locking Device With Integrated Distance Bumper (Both Required):
 - a. Part number: T51.1901.PS L.
 - b. Part number: T51.1901.PS R.
 4. Power Supply Set:
 - a. Part number: Z10NE02UG10.

- G. Approved Product: Blum bottom bracket for TANDEM.
 1. Bottom Bracket:
 - a. Part number: Z10D7201.01.
 2. Drive Unit:
 - a. Part number: Z10A3000.02.
 3. Distance Bumper:
 - a. Part number: 933.0531 - 5 mm diameter bumper.
 - b. Part number: 933.1220 - Screw-on bumper.
 4. Power Supply Set:
 - a. Part number: Z10NE02UG10.

- H. Approved Product: Blum inset bottom bracket for TANDEM
 1. Bottom Bracket:
 - a. Part number: Z10D7201.01.
 2. Drive Unit:
 - a. Part number: Z10A3000.02.
 3. Locking Device With Integrated Distance Bumper (Both Required):
 - a. Part number: T51.1901.PS L.
 - b. Part number: T51.1901.PS R.
 4. Power Supply Set:
 - a. Part number: Z10NE02UG10

- I. Approved Product: Blum Waste/recycle set.
 1. Part number: Z10NA20UGUS.

- J. Approved Product: Blum vertical aluminum profile for TANDEMBOX
 1. Vertical Aluminum Profile:
 - a. Part number: Z10T720AB - Profile with cable, length 28-3/8 inches (720 mm).
 - b. Part number: Z10T1170A - Profile without cable, length 46 inches (1170 mm)
 2. Top And Bottom Adapter Set:
 - a. Part number: Z10D01E0.01 - For use with horizontal stretcher rail.
 3. Back And Bottom Adapter Set:
 - a. Part number: Z10D01EA.01 - For use with back stretcher rail.
 4. Drive Unit:
 - a. Part number: Z10A3000.02.

5. Distance Bumper:
 - a. Part number: 933.0531 - 5 mm diameter bumper.
 - b. Part number: 933.1220 - Screw-on bumper.
 6. Power Supply Set:
 - a. Part number: Z10NE02UG10.
- K. Approved Product: Blum horizontal aluminum profile for TANDEMBOX.
1. Horizontal Aluminum Profile:
 - a. Part number: Z10T1143B - Profile length 45 inches (1143 mm).
 2. Adapter Set:
 - a. Part number: Z10D5210.US.
 3. Drive Unit:
 - a. Part number: Z10A3000.02.
 4. Distance Bumper:
 - a. Part number: 933.0531 - 5 mm diameter bumper.
 - b. Part number: 933.1220 - Screw-on bumper.
 5. Power Supply Set:
 - a. Part number: Z10NE02UG10.
- L. Approved Product: Blum top bracket for TANDEMBOX.
1. Top Bracket With Adapter:
 - a. Part number: Z10D6252.
 2. Drive Unit:
 - a. Part number: Z10A3000.02.
 3. Distance Bumper:
 - a. Part number: 933.0531 - 5 mm diameter bumper.
 - b. Part number: 933.1220 - Screw-on bumper.
 4. Power Supply Set:
 - a. Part number: Z10NE02UG10.
- M. Approved Product: Blum bottom bracket for TANDEMBOX.
1. Bottom Bracket:
 - a. Part number: Z10D7201.01.
 2. Drive Unit:
 - a. Part number: Z10A3000.02.
 3. Distance Bumper:
 - a. Part number: 933.0531 - 5 mm diameter bumper.
 - b. Part number: 933.1220 - Screw-on bumper.
 4. Power Supply Set:
 - a. Part number: Z10NE02UG10.

PART 9 EXECUTION

9.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

9.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

9.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

9.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

07 21 19 – FOAM-IN-PLACE INSULATION**PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Sealant foams.
- B. Spray foams.
- C. Adhesive foams.
- D. Pour-In-place foams.

1.2 RELATED SECTIONS

- A. Section 06 12 16 - Stressed Skin Panels.
- B. Section 07 27 00 - Air Barriers.
- C. Section 07 26 00 - Vapor Retarders.
- D. Section 07 27 26 - Fluid-Applied Membrane Air Barriers .
- E. Section 07 21 26 - Blown Insulation.
- F. Section 07 91 26 - Joint Fillers.
- G. Section 08 11 00 - Metal Doors and Frames.
- H. Section 08 54 13 - Fiberglass Windows.

1.3 REFERENCES

- A. American Architectural Manufacturers Association (AAMA) 812-04 - Voluntary practice for assessment of single component aerosol expanding polyurethane foams for sealing rough openings of fenestration installations.
- B. ASTM International (ASTM):
 - 1. ASTM C423 - Standard test method for sound absorption and sound absorption coefficients by reverberation room method.
 - 2. ASTM C518 - Standard test method for steady state thermal transmission properties by means of the heat flow meter apparatus.
 - 3. ASTM C1620 - Standard specification for aerosol polyurethane and aerosol latex foam sealants.
 - 4. ASTM D1621 - Standard test method for compressive properties of ridged cellular plastics.
 - 5. ASTM D1622 - Standard test method for apparent density of rigid cellular plastics.
 - 6. ASTM D2842 - Standard test method for water absorption of rigid cellular plastics.
 - 7. ASTM D3498 - Standard specifications for adhesives and field gluing plywood to lumber framing for floor systems.
 - 8. ASTM D6464 - Standard specification for expandable foam adhesives for fastening gypsum wallboard to wood framing.
 - 9. ASTM E72 - Standard test methods of conducting strength tests of panels for building construction.
 - 10. ASTM E 84/UL 723 - Standard test method for surface burning characteristics of building materials.
 - 11. ASTM E90 - Standard test method for laboratory measurement of airborne sound transmission loss of building partitions and elements.
 - 12. ASTM E96 - Standard test methods for water vapor transmission of materials.
 - 13. ASTM E283 - Standard test method for determining rate of air leakage through exterior windows, curtain walls, and doors under specified pressure differences across the specimen.
 - 14. ASTM E2178 - Standard test method of air permeance of building materials.
 - 15. ASTM G21 - Standard practice for determining resistance of synthetic polymeric materials to fungi.
- C. CAN/ULC S711.1 - Standard for thermal insulation - bead-applied two component polyurethane air sealant foam part 1: material specification.
- D. ICC-ES AC377 - Acceptance criteria for spray applied foam plastic insulation.
- E. NFPA 286 - Standard methods of fire tests for evaluating contribution of wall and ceiling interior finish to room fire growth.
- F. UL94 - Standard for safety of flammability of plastic materials for parts in devices and appliances.
- G. UL 2818 - GREENGUARD GOLD certification program for chemical emissions of building materials, finishes, and furnishings.
- H. 33 CFR 183.114 Subpart F Title 33 Code of Federal Regulations - navigation and navigable waters - specification requirements for flotation.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.

1.5 QUALITY ASSURANCE

Installer Qualifications: Provide qualified installers, familiar with the application and products being used per manufacturer's guidelines.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Comply with manufacturer's recommended temperature and substrate requirements during application and curing of the product. Substrate must be clean, dry, firm, free of loose particles and free of dust, grease and mold release agents. Protect surfaces not to be foamed.
- B. Provide adequate ventilation where the product is being applied to help control worker exposure to airborne contaminants.
- C. Consult the manufacturer's Safety Data Sheets, product stewardship guidelines and operating instructions before use.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store in a dry location. Comply with manufacturers operating and technical instructions for storage, handling and personal protection information prior to and during product installation.
- B. Do not store full tanks above 100 degree F (38 degree C). Storage of partial or used tanks above 90 degree F (32 degree C) for extended periods may reduce the shelf life of the product. Avoid long-term storage in direct sunlight or near sources of heat.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

PART 2 PRODUCTS**2.1 MANUFACTURERS**

- A. Acceptable Manufacturer: Fomo Products, Inc., or architect's approved equal.
- B. Requests for substitutions will be considered.

2.2 SEALANT FOAMS

- A. Product: Fomo Products, Inc. Handi-Foam Sealant.
 - 1. ASTM C518: 4.7/inch.
 - 2. ASTM E2178: .00028 cfm/ft2.
 - 3. UL 723 Classified #R13919 Flame Spread 25 Smoke Developed 50 (12.5 percent).
 - 4. ASTM E283: less than .0025 cfm/ft2.
 - 5. ULC Classified - File #R13919 CAN/ULC S102 Flame Spread 15 Smoke Developed 25 (12.5 percent).
 - 6. UL 2818 - UL GREENGUARD GOLD for low chemical emissions.
- B. Product: Fomo Products, Inc. Handi-Foam 40 Series.
 - 1. ASTM E283: less than .0025 cfm/ft2 at 1.57 psf.
 - 2. UL 723 Classified #R13919 Flame Spread 5 Smoke Developed 10 (8.3 percent).
 - 3. UL 2818 - UL GREENGUARD GOLD for low chemical emissions.
- C. Product: Fomo Products, Inc. Handi-Foam Cylinder 40 Series.
 - 1. ASTM C518: 5.0/inch.
 - 2. ASTM E283: less than .0025 cfm/ft2.
 - 3. UL 723 Classified #R13919 Flame Spread 5 Smoke Developed 10 (12.5 percent).
 - 4. UL 2818 - UL GREENGUARD GOLD for low chemical emissions.
- D. Product: Fomo Products, Inc. Handi-Foam Eco Foam.
 - 1. Shall contain over 10 percent soy renewable content. Each pound of the soy based polyol used replaces a pound of petroleum based polyol and results in a 5.6 lb. CO2 benefit to the atmosphere.

2. ASTM E84: Flame Spread 25 Smoke Developed 50 (12.5 percent).
3. UL 2818 - UL GREENGUARD GOLD for low chemical emissions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Product shall be installed according to local code.
- C. Follow ambient and substrate temperature range recommendations when applying the product.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. For exterior applications, provide a coating or painting for protection from UV radiation.
- C. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

07 25 00 – WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Materials and installation of air and moisture barrier complete over wall sheathing.

1.02 DESIGN REQUIREMENTS

A. Deflection Criteria: maximum allowable deflection normal to the plane of the wall: L/240

B. Wind Load: Conform to code requirements.

A. Moisture Control:

1. Minimize condensation within the assembly.
2. Drain water directly to the exterior where it is likely to penetrate components in the wall assembly (windows and doors, for example).
2. Provide flashing to direct water to the exterior in accordance with code requirements, including, above window and door heads, beneath window and door sills, at roof/wall intersections, decks, intersections of lower walls with higher walls, and at the base of the wall.

B. Air Barrier Continuity: Provide continuous air barrier system of compatible air barrier components.

E. Mechanical Ventilation: maintain positive pressurization and indoor humidity levels between 40- 60% at all times.

1.03 PERFORMANCE REQUIREMENTS

A. Air/Moisture Barrier Performance Data:

TEST	METHOD	CRITERIA	RESULTS
Water Penetration Resistance	AATCC 127 (Water Column)	Resist 21.6 in (55 cm) water for 5 hours before and after aging	No water penetration before and after aging
Water Penetration Testing	ASTM E 1233 / ASTM E 331	No water at exterior plane of sheathing. (exterior gypsum, Dens-Glass® Gold, plywood, OSB) after 10 cycles @ 80% design load and 75 minutes water spray at 6.24 psf (299 Pa) differential	No water penetration
Water Resistance Testing	ASTM D 2247	Absence of deleterious effects after 14 day exposure	No deleterious effects after 14 day exposure
Freeze/Thaw Resistance	ICBO Method (AC 24)	No visible effects (cracking, checking, delamination, erosion) when viewed at 5x	No visible deleterious effects at 5x magnification
Water Vapor Transmission	ASTM E 96 Method B (Water Method)	Measure	Sto Gold Fill: 17.3 perms [994 ng/(Pa·s·m ²)] Sto Gold Coat: 5.7 perms [327 ng/(Pa·s·m ²)]
Air Leakage: Wall Assembly with Sto Gold Fill & Sto Gold Coat	ASTM E 283 (SBCCI PST & ESI Method)	<0.06 cfm/ft ² @ 1.56 psf (0.00030 m ³ /s·m ² @ 75 Pa)	0.0044 cfm/ft ² (0.000022 m ³ /s·m ²)
Air Leakage: Sto Gold Fill	ASTM E 283 (CCMC Technical Guide Method)	< 0.003 ft ³ /min·ft ² @ 1.56psf (< 0.02 L/s·m ² @ 75 Pa)	< 0.0002 ft ³ /min·ft ² (< 0.0014 L/s·m ²)

City of Rancho Mirage		City Project No. CP15-315	Rancho Mirage Observatory
Structural Integrity	ASTM E 330	2 inches (51 mm) water pressure (positive & negative) for 1 hour.	No loss of structural integrity
Dry Tensile Strength	ASTM D 882	20 lbs/in (3503 N/m) minimum before and after aging	Sto Gold Fill: 159 pli (27.8 kN/m) before aging 213 pli (37.3 kN/m after aging)
Flexibility	ASTM D 522	No cracking or delamination using 1/8" (3 mm) mandrel at 14°F (-10°C) before and after aging	No cracking or delamination before and after aging
Tensile Adhesion	ASTM C 297	>15 psi (103 kPa)	Gypsum (ASTM C 79): >30 psi (206 kPa) Gypsum (ASTM C 1177): > 30 psi (206 kPa) Exposure 1 OSB: > 50 psi (344 kPa) Exterior Plywood: > 90 psi (620 kPa)
Surface Burning	ASTM E 84	Flame Spread: <25 Smoke Developed: <450	Flame Spread: 5 Smoke Developed: 10 NFPA Class A, UBC Class 1 building material
Fire Testing	UBC 26-9	No increase in fire hazard	Pass

1.04 SUBMITTALS

- A. Manufacturer's specifications, details and product data.
- B. Samples for approval as directed by Owner's Representative or owner.
- C. Manufacturer's standard warranty.
- D. Prepare and submit project-specific details (when required by contract documents).

1.05 QUALITY ASSURANCE

- A. Manufacturer requirements
Manufacturer of exterior wall air and moisture barrier materials for a minimum of 20 years in North America.
ISO 9001 Certified.
- B. Contractor requirements
 1. Knowledgeable in the proper use and handling of Sto materials.
 2. Employ skilled mechanics who are experienced and knowledgeable in air and moisture barrier application, and familiar with the requirements of the specified work.
 3. Provide the proper equipment, manpower and supervision on the job-site to install the system in compliance with Sto's published specifications.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in their original sealed containers bearing manufacturer's name and identification of product.
- B. Protect coatings (pail products) from freezing temperatures and temperatures in excess of 90° F (32° Store away from direct sunlight.

1.07 PROJECT/SITE CONDITIONS

- A. Maintain ambient and surface temperatures above 40° F (4° C) during application and drying period, minimum 24 hours after application of air and moisture barrier.
- B. Provide supplementary heat for installation in temperatures less than 40° F (4° C) or if surface temperature is likely to fall below 40° F (4° C). (*Note: surface temperature is lower than air temperature at night*).
- C. Provide protection of surrounding areas and adjacent surfaces from application of materials.

1.08 COORDINATION/SCHEDULING

- A. Coordinate installation of foundation waterproofing, roofing membrane, windows, doors and other wall penetrations to provide a continuous air barrier.
- B. Provide protection of rough openings before installing windows, doors, and other penetrations through the wall.

- City of Rancho Mirage City Project No. CP15-315 Rancho Mirage Observatory□
- C. Provide sill flashing to direct water to the exterior before windows and doors are installed.
 - D. Coordinate installation of windows and doors so air barrier components are connected to them to provide a continuous air barrier.
 - E. Install window and door head flashing immediately after windows and doors are installed.
 - F. Install diverter flashings wherever water can enter the assembly to direct water to the exterior.

1.09 WARRANTY

- A. Provide manufacturer's standard warranty. Ten (10) years when used in conjunction with EIFS and five (5) years when used under other claddings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Sto Corp. – Basis of Design
Contact – Sto Strategic Accounts at 1-888-STO-EIFS (888-786-3437)
- B. Substitutions: Submit in accordance with Section 01600. Submitted products from other manufacturers must be equal in performance criteria as described in section 1.03 and in warranty (section 1.09).

2.02 AIR AND MOISTURE BARRIER

- A. Fluid applied system equal to Sto Guard by Sto Corporation.
 - 1. Joint Treatment: Sto Gold Fill™—ready mixed acrylic based flexible joint treatment for rough opening protection and joint treatment of wall sheathing.
 - 2. Waterproof Coating: Sto Gold Coat™—ready mixed acrylic based waterproof coating for wall sheathing.

2.03 REINFORCING MESH

- A. Sto Guard Mesh - nominal 4.2 oz/sq. yd. (142 g/m²), self-adhesive, flexible, symmetrical, interlaced glass fiber fabric, with alkaline resistant coating for compatibility with Sto materials (*used with Sto Gold Fill™ to reinforce rough openings, inside and outside corners and sheathing joints*).
- B. Sto Detail Mesh - nominal 4.2 oz/sq. yd. (142 g/m²), flexible, symmetrical, interlaced glass fiber fabric, with alkaline resistant coating for compatibility with Sto materials (*used with Sto Gold Fill™ to reinforce rough openings, inside and outside corners and sheathing joints*).

2.04 MIXING

- A. Mix materials with a clean, rust-free electric drill and paddle.
- B. Do not dilute materials with water or add other ingredients.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Inspect concrete and concrete masonry surfaces for:
 - 1. Contamination — algae, chalkiness, dirt, dust, efflorescence, form oil, fungus, grease, mildew or other foreign substances.
 - 2. Surface absorption and chalkiness.
 - 3. Cracks — measure crack width and record location of cracks.
 - 4. Damage and deterioration.
 - 5. Moisture content and moisture damage — use a moisture meter to determine if the surface is dry enough to receive the air and moisture barrier and record any areas of moisture damage or excess moisture.
 - 6. Compliance with specification tolerances — record areas that are out of tolerance (greater than 1/4 inch in 8-0 feet [6 mm in 2438 mm] deviation in plane).
- B. Inspect sheathing application for compliance with applicable requirement:
 - 1. Glass mat faced gypsum sheathing — Georgia Pacific Publication 102250
 - 2. Exterior Grade and Exposure I wood based sheathing — APA E30
- C. Report deviations from the requirements of project specifications or other conditions that might adversely affect the air and moisture barrier installation. Do not start work until deviations are corrected.

3.02 SURFACE PREPARATION

- B. Remove surface contaminants and replace damaged sheathing.
- C. Spot surface defects in sheathing with joint compound.
- C. Repair cracks, spalls, or other damage in concrete or concrete masonry surfaces

3.03 INSTALLATION

- A. Install air/moisture barrier in compliance with manufacturer's written instructions.

END OF SECTION 07195

07 26 24 – CONCRETE SLAB MOISTURE CONTROL**PART 2 GENERAL****2.1 QUALITY ASSURANCE**

- A. Perform work in accordance with ACI 301, 304, 305, 306, 309, and 318.
- B. Obtain materials from same source throughout the Work.
- C. **CAL Green:** Concrete slab foundations are required to have a vapor retarder by California Building Code, CCR, Title 24, Part 2, Chapter 19, shall also comply with this section. At a minimum, use a 4-inch thick base of ½ inch clean aggregate with a vapor barrier in direct contact with concrete mix design which will address bleeding, shrinkage, and curing. ACI 302.2R-06.

2.2 REGULATORY REQUIREMENTS

- A. Conform to applicable building code.
- B. ASTM Standards
 - 1. **C168 Terminology Relating to Thermal Insulation**
 - 2. **D828 Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus**
 - 3. **D882 Test Method for Tensile Properties of Thin Plastic Sheeting**
 - 4. **D1709 Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method**
 - 5. **E96/E96M Test Methods for Water Vapor Transmission of Materials**
 - 6. **E154 Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover**
 - 7. **E631 Terminology of Building Constructions**
 - 8. **E1643 Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs**
 - 9. **E1993 Specification for Bituminous Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs**
 - 10. **F1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor**

2.3 COORDINATION

- A. Notify responsible trades of schedules of concrete pours so as to allow adequate time for installation of their work.

2.4 DELIVERY, STORAGE AND HANDLING

- A. Polyethylene sheeting: use a product specifically designed as a vapor retarder with a Class A, rating, per ASTM E 1745. Stego Wrap Class A, or approved equal: a multi-layer plastic extrusion manufactured with the highest grade of prime, virgin, polyolefin resins.
- B. Minimum ½ inch diameter clean aggregate (clean crushed material with about 10 to 30 percent passing the No. 100 sieve and free of clay or organic material).
- C. Acoustical Sealant or Butyl Caulk
- D. Treated wood furring strips

PART 3 PRODUCTS**3.1 ACCESSORIES**

- A. Sheet Vapor Barrier:

3.2 BEST PRACTICES

- A. Preparations for pouring a concrete slab should include making sure the soil that will be beneath is level so that when the gravel is added, a consistent 4-in. minimum thickness is maintained.
- B. Polyethylene sheeting is then placed over the entire gravel area and touches each perimeter wall. Lengths of sheeting laid side-by-side must overlap at least 6 in. (12-in. overlaps are often easier because it can be difficult to cut long lengths of polyethylene in straight lines) and the two sheet surfaces sealed or taped together.
- C. A continuous bead of acoustical sealant, butyl rubber or butyl acrylic caulk forms the most durable bond.
- D. Seams are also sealed with tape manufactured to seal or patch polyethylene, such as builder's tapes and tapes used to repair polyethylene greenhouses.

- E. Polyethylene sheeting shall be applied directly over the soil, with all lapped sheets sealed or taped as described above. However, the polyethylene must lap up each perimeter wall far enough to be sealed to the wall with a ½-in. wide bead of acoustical sealant or butyl caulk.
- F. Treated wood furring strips or other insect-resistant material must then be nailed or screwed to the wall to provide a permanent mechanical attachment of the up-turned polyethylene to the foundation walls.
- G. The polyethylene should also be sealed at any penetrations through the sheeting, such as steel columns. Note: use moisture resistive tape when joining the sheets of the vapor retarder material.
- H. Do not disturb or damage vapor barrier while placing concrete. Repair damaged vapor barrier. The final step is to pour the concrete slab over the sealed polyethylene sheeting.

END OF SECTION

07 60 00 – Sheet Metal Flashing & Trim

PART 1 GENERAL – not used

PART 2 PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS - SHEET MATERIALS

- A. Structural Quality Aluminum-Zinc Alloy-Coated Steel Sheet:
 - 1. **Hot-dip aluminum-zinc-coated steel sheet (Galvalume) complying with ASTM A 792 with class AZ-50 coating.**
 - 2. **Grade 40 or to suit manufacturer's standards, smooth finish.**
- B. Sheet Metal Thickness/Mass:
 - 1. **Flashing: In accordance with SMACNA Chapter 4.**
 - 2. **Gutters: In accordance with SMACNA Table 1-5.**
 - 3. **Downspouts: In accordance with SMACNA Table 1-9.**
 - 4. **Coping, Facia/Gravel Stop, Scupper: In accordance with SMACNA Table 3-1.**
 - 5. **Conductor Heads: In accordance with SMACNA Figure 1-25.**
- C. Substitutions: Submit under provisions of Section 01 32 19.

2.2 FABRICATION

- A. Form sections true to shape, accurate in size, square, free from distortion and defects, to profiles indicated in accordance with SMACNA Architectural Sheet Metal Manual.
- B. Fabricate cleats and starter strips of same material as sheet, interlockable with sheet.
- C. Form pieces in longest practical lengths.
- D. Hem exposed flashings on underside 1/2 inch; miter and seam corners.
- E. Form materials which are typically concealed from view by the public with lap seams. On exposed seams, use butt-seam/back-up plate type unless noted or detailed otherwise.
- F. Solder and seal metal joints except those indicated or required to be expansive type joints. After soldering, remove flux. Wipe and wash solder joints clean.
- G. Fabricate corners from one place with minimum 18 inch long legs; solder for rigidity; seal with sealant.
- H. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- I. Fabricate flashings to allow toe to extend minimum 2 inches over wall surfaces.
- J. Fabricate as much as possible in shop with machinery to eliminate as much hand tooling on the job as possible. Shop fabricate to allow for adjustments in the field for proper anchoring and joining.

2.3 ACCESSORIES

- A. Fasteners
 - 1. **Nails: AISI Series 300 for galvanized steel. Use annular ring shank type, No. 12 gage or larger to suit application, of sufficient length to penetrate backing material at least 7/8 inch.**
- B. Solder Materials
 - 1. **Flux: Type as recommended by sheet material manufacturer; not detrimental to base material. Use resin type flux for terne metal.**
 - 2. **Solder: ASTM B 32 type, 50 percent tin/50 percent lead for galvanized steel.**
- C. Underlayment: ASTM D 6221, Type I Reinforced modified bitumen membrane flashing consisting of a fiberglass scrim and polyester mat reinforcement.
- D. Sealants: Two component polyurethane, non-sagging, sealant as specified in Section 07 92 00.
- E. Reglets:
 - 1. **Acceptable Product: Type ST Spring-lok flashing reglet by Fry Reglet, Norcross, GA**
- F. Roofing Cement: ASTM D 4586, Type I, asbestos free, asphalt based.

2.4 FINISHES

- A. Refer to Section 09 91 00.

PART 3 EXECUTION

3.1 PREPARATION

- A. Field measure site conditions prior to fabricating work.

- B. Install starter and edge strips, and cleats before starting installation.
- C. Install one layer of underlayment prior to installing copings and parapet caps.

3.2 INSTALLATION

- A. Install using skilled workmen in accordance with manufacturer's printed instruction and recommendations.
- B. Conform to drawing details included in manuals published by SMACNA.
- C. Insert flashings into reglets to form tight fit. Secure in place with wedges at maximum 12 inches on center. Seal flashings into reglets with sealant.
- D. Secure flashings in place using concealed fasteners. Use exposed fasteners only in locations approved by Owner's Representative.
- E. Lap seam flashings and work not normally exposed to view. Use butt joint with back-up plate joint method exposed flashings, coping caps, and guards. Seal joints.
- F. Apply plastic cement compound between metal flashings and felt flashings.
- G. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- H. Seal metal joints watertight.
- I. On soldered metal joints, make watertight for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.
- J. Install expansion joints at frequency as recommended in SMACNA Architectural Sheet Metal Manual. Do not fasten seams such that movement is restricted. Coordinate expansion joint locations with joints in adjacent materials.

3.3 QUALITY CONTROL

- A. Install surfaces flat such that from normal viewing distances, no waviness or oil canning is visible.

3.4 SCHEDULE OF PRODUCTS USED

- A. Flashing and Counter Flashing: Fabricate as indicated on Drawings and in accordance with SMACNA Architectural Sheet Metal Manual, Chapter 4.
- B. Coping: As indicated on Drawings and in accordance with SMACNA Figure 3-4A.

END OF SECTION

07 61 12– CORRUGATED ROOF PANELS

PART 1 – GENERAL

1.1 Description

A. General

1. Furnish all labor, material, tools, equipment, and services for all preformed *roofing*, 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. Meet Cool Roof Values for solar reflectance and Thermal Emittance. Thermal Emittance = 0.75 min; Solar reflectance index of 75 minimum; Aged reflectance factor of 0.63 minimum.
4. See Division 1 for General Requirements.

1.2 Quality Assurance

A. Applicable standards:

1. SMACNA: "Architectural Sheet Metal Manual" Sheet Metal and Air Conditioning Contractors National Association, Inc.
2. AISC: "Steel Construction Manual" American Institute of Steel Construction.
3. AISI: "Cold Form Steel Design Manual" American Iron and Steel Institute.
4. ASTM A792-89: Standard Specification for Steel Sheet, Aluminum-Zinc Alloy Coated by the Hot Dip Process, General Requirements
5. ASTM A527-90: Standard Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
6. ASTM A526-90: Standard Specification for Steel Sheet, Zinc, Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.
7. ASTM A446-91: Standard Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
8. ASTM B 117: Salt spray testing of coating 1000 Hrs.
9. ASTM G 23: Accelerated testing of coating 2000 hrs.
 1. Manufacturer has a minimum of five years' experience in manufacturing panels of this nature in a permanent, stationary, indoor production facility utilizing industrial equipment.
 2. Manufacturer has current nationally recognized model building code agency product approvals for fastening design pressure capacities that meet projects uplift resistance test requirements per (UL 580 Class 90 or higher).
 3. Manufacturer has an approved independent quality assurance inspection program to validate certified material and finished product specifications.
 4. Manufacturer has permanent ink marking on panels that identifies the manufacturer, building code approvals, and date of production for material traceability and warranty validation.
 5. Manufacturer's product is listed in the UL (Underwriters Laboratory) fire resistant directory.
 6. Installation of panels and accessories by installers with a minimum of two years' experience in panel projects of this nature.

1.3 Submittals

1. Submit complete shop drawings and erection details to Architect for review. Do not proceed with manufacture prior to review of shop drawings. Do not use drawings prepared by Architect for shop or erection drawings.
2. Shop drawings show methods of erection, elevations, and plans of roof panels, sections and details, anticipated loads, flashings, roof curbs, vents, sealants, interfaces with all materials not supplied and proposed identification of component parts and their finishes.

3. Submit samples and color strips for all proposed finishes.
 - a. Submit one 12 in. long sample of panel.
 - b. Submit two 2 in round color chip samples in color selected by Architect.
4. Metal panel manufacturer, upon final acceptance for project, furnish a warranty covering bare metal against rupture, structural failure, and perforation due to normal atmospheric corrosion exposure for a period of twenty-five (25) years.
5. Covering panel finish against cracking, checking, blistering, peeling, flaking, chipping, chalking, and fading for a period of twenty-five (25) years.

1.4 Product Delivery, Storage and Handling

1. Deliver panels to job site properly packaged to provide protection against transportation damage.
2. Exercise extreme care in unloading, storing, and erecting panels to prevent bending, warping, twisting, end and surface damage.
3. Store all material and accessories above ground on well skidded platforms.
4. Store under waterproof covering. Provide proper ventilation to panels to prevent condensation buildup between each panel.

PART 2 - PRODUCTS

2.1 Materials

- A. Panel profile:
 1. 1/2" height rib x 24" width. 21 1/2" Coverage (roofing)
- B. Panel Style:
 1. Sidelap seam
 2. Exposed fastener
- C. Gauge: 24 gauge
- E. Texture: Smooth
- F. Finish: *(see manufacturer's spec at end of this section)*
- H. Acceptable manufacturer:
 1. Corten AZP RAW (855) 426-7836

2.02 Fabrication

- A. Roll form panels in continuous lengths, full length of detailed runs.

PART 3 - EXECUTION

3.01 Surface Conditions

- A. Inspection:
 1. Inspect installed work of other trades and verify that such work is complete to a point where this work may continue.
 2. Verify that installation may be made in accordance with approved shop drawings and manufacturer's instructions.
 1. In event of discrepancy, notify Architect.
 2. Do not proceed with installation until discrepancies have been resolved.
- B. Discrepancies:

3.02 Installation

- A. Install panels so that they are weather tight, without waves, warps, buckles, fastening, stresses or

- distortion, allowing for expansion and contraction.
- B. Install panels in accordance with manufacturer’s installation instructions and shop drawings.
- C. Provide concealed anchors at all panel attachment locations.
- D. Install panels plumb, level, and straight with seams and ribs/battens parallel, conforming to design as indicated.
- E. Use ¾ inch Armoroc Panels installed over solid insulation using corrosion resistant self-countersinking head screws (Grabber Part No. CHS8200JBM, or equal) Fasteners to be minimum #8 diameter with self-drilling points and 4 1/2 inches long.
- F. Use PEMCO 5100 non-flammable, solvent free, zero V.O.C., polyurethane adhesive as manufactured by Alpha Systems, Inc. or equal. Seal all T and G and saw cut connections.
- G. Install heavy slip sheets (non-asphaltic fiberglass-based underlayment meeting ASTM D146, D1922 and D4869: allows metal to expand and contract freely). Do not use asphalt impregnated felts or building papers (asphalt can heat up and melt and bond metal to surface).
- H. Overlap corrugated panels at vertical joints and secure with screws (per manufacturer’s installation instructions, minimum #10x1.5” hex head with banded neoprene washer, non-corrosive type, through both panels. Fasten by sliding a lip on one panel into a slot on the adjoining one. Cover the roof with metal panels. Finish a peak or other roof top with roof or edge caps which overlap the joint. Use recommended edge finishing on the sides and eave of the roof.

3.03 Cleaning, Protection

- A. Dispose of excess materials and remove debris from site.
- B. Clean work in accordance with manufacturer’s recommendations.
- C. Protect work against damage until final acceptance. Replace or repair to the satisfaction of the Architect, any work that becomes damaged prior to final acceptance.
- D. Touch up minor scratches and abrasions.
- E. At completion of each day’s work and at work completion, sweep panels and flashing clean. Do not allow fasteners, cuttings, filings or scrapes to accumulate on finished surfaces.

Performance	Test Method	G-90 Hot-Dipped Galvanized coated	GALVALUME® coated steel
Adhesion	ASTM D 3359	No loss of adhesion	No loss of adhesion
Flexibility	ASTM D 4145	1T to 3T, no loss of adhesion	1T to 3T, no loss of adhesion
Pencil Hardness	ASTM D 3363	HBM minimum	HBM minimum
Reverse Impact	ASTM D 2794	3x metal thickness, NTO	3x metal thickness, NTO
Abrasion Resistance	ASTM D 968	65 ±10 liters per ml	65 ±10 liters per ml
Specular Gloss	ASTM D 523	Less than 25 at 60°	Less than 25 at 60°
Salt Spray	ASTM B 117	1,000 hours - 1/16" max creep from scribe	1,000 hours - 1/16" max creep from scribe
Humidity	ASTM D 2247	2,000 hours - no field blisters	2,000 hours - no field blisters
Dew Cycle Weatherometer	ASTM D 3361	1,000 hours - Chalk Rating no less than 8	1,000 hours - Chalk Rating no less than 8



AT A GLANCE		
MATERIAL	GALVALUME® coated steel sheet Galvanized coated steel sheet	
MATERIAL WIDTH	GALVALUME® coated steel sheet - 49 in maximum Galvanized coated steel sheet - 62 in maximum	
MATERIAL THICKNESS*	GALVALUME® coated steel sheet	Galvanized coated steel sheet
	0142 in minimum 040 in maximum	0142 in minimum 057 in maximum
MAXIMUM CROSS SECTION*	STEEL 24 sq in	
COIL SIZE ENTRY	60,000 lb maximum 78 in OD maximum 20 in and 24 in ID	

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Precoat Metals

07 92 00 – SEALANTS and CAULKING**PART 1 GENERAL****1.1 QUALITY ASSURANCE****A. Certifications:****1. Manufacturer's certification that products:**

- a. Furnished for the specific project meet or exceed specified requirements.
- b. Assembled for each joint are compatible with each other and with joint substrates under conditions of service and application.
- c. Are suitable for the indicated use.

2. Manufacturer's certification that sealants, primers, and cleaners, comply with local regulations controlling the use of volatile organic compounds.**3. Contractor's and installer's certification that products are installed in accordance with Contract Documents, based on inspection and testing specified as part of Field Quality Control.****4. CAL Green: Table 5.504.4.2 Sealant VOC Limits of 2013 CAL Green non-residential compliance mandatory measures in accordance with SCAQMD rule 1168.****5. Qualifications of manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.****B. Qualifications of installers:****1. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.****2. Proper caulking and proper installation of sealants require that installers be thoroughly trained and experienced in the necessary skills and thoroughly familiar with the specified requirements.****3. For caulking and installation of sealants throughout the Work, use only personnel who have been specifically trained in such procedures and who are completely familiar with the joint details shown on the Drawings and the installation requirements called for in this Section.****C. SEQUENCING****1. Coordinate installation of sealants with substrates to which they are applied.****2. Manufacturers' Data: Submit a complete materials list showing all items proposed to be furnished and installed under this Section.****3. Sufficient data to demonstrate that all such materials meet or exceed the specified requirements.****4. Specifications, installation instructions, and general recommendations from the materials manufacturers showing procedures under which it is proposed that the materials be installed.****5. Upon approval by the Architect, the proposed installation procedures will become the basis for inspecting and accepting or rejecting actual installation procedures used on the work****1.2 WARRANTY****A. Provide warranties under provisions of Section 01 78 00.****B. Warrant installed products to be free from defects in material, labor, or installation techniques for 2 years.****C. Include coverage for installed sealants and accessories which:****1. Fail to achieve air tight seal.****2. Fail to achieve watertight seal.****3. Exhibit loss of adhesion.**

4. **Exhibit loss of cohesion.**
5. **Do not cure.**

PART 2 PRODUCTS

2.1 MATERIALS

A. Acrylic Latex (Designation AL):

1. **Description:**

- a. ASTM C 834.
- b. Non-sag; non-staining; non-bleeding.
- c. Joint movement range without cohesive/adhesive failure: Plus 7.5 percent to minus 7.5 percent of joint width.
- d. Color: As selected by Owner's Representative from manufacturer's full color range.

2. **Acceptable Products:**

- a. AC-20, Pecora.
- b. Sonolac, Sonneborn.
- c. Acrylic Latex 834, Tremco.

B. Silicone - General Purpose (Designation S-GP):

1. **Description:**

- a. ASTM C 920:
 - 1) Type: S
 - 2) Grade: NS
 - 3) Class: 25
 - 4) Uses: NT, [M,] G, A, O
- b. Low modulus, single component, neutral curing, non-staining, non-bleeding silicone sealant.
- c. Joint movement range without cohesive/adhesive failure: Plus 50 percent to minus 50 percent of joint width.
- d. Color: Selected by Owner's Representative from manufacturer's full color range.

2. **Acceptable Products:**

- a. 795, Dow Corning.
- b. Silpruf, General Electric.
- c. 864, Pecora.
- d. Rhodorsil 5C, Rhone-Poulenc.
- e. Spectrum 1, Tremco.

C. Silicone - Sanitary (Designation S-S):

1. **Description:**

- a. ASTM C 920:
 - 1) Type: S
 - 2) Grade: NS
 - 3) Class: 25
 - 4) Uses: NT, M, G, A, O
- b. Neutral or acid curing, non-staining, non-bleeding, fungicide-containing.
- c. Color: Selected by Owner's Representative from manufacturer's full color range.
- d. Complying with United States Food and Drug Administration Regulation 21CFR-177-6000.

2. **Acceptable products:**

- a. 786 Mildew-Resistant Silicone Sealant, Dow Corning.
- b. Sanitary 1700, General Electric.
- c. 863, Pecora.
- d. Rhodorsil 3B, Rhone Poulenc.
- e. Tremsil 600, Tremco.

D. Urethane - Traffic-Bearing (Designation U-TB):

1. Description:

- a. ASTM C 920:
 - 1) Type: M
 - 2) Grade: P or NS
 - 3) Class: 25
 - 4) Uses: T, M, O
- b. Chemical curing, non-staining, non-bleeding.
- c. Joint movement range without cohesive/adhesive failure: Plus 25 percent to minus 25 percent of joint width.
- d. Shore A hardness: 35 minimum, when tested in accordance with ASTM D 2240.
- e. Color: Selected by Owner's Representative from manufacturer's full color range

2. Acceptable Products:

- a. Vulkem 245, 202, Mameco.
- b. Dynatred, Pecora.
- c. Sikaflex 2c/SL, Sika.
- d. THC 900/901, Tremco.

E. Sealants:

1. General: Except as specifically otherwise directed by the Architect, use only the type of sealants described in this Article
2. Sealant shall be two-component, rubber-based compound conforming to Fed. Spec. fl-S-00227E. Each color and each class of sealant shall be the product of a single manufacturer.
3. Bulk Sealants:
 - a. For interior and exterior horizontal application subject to pedestrian or vehicular traffic; the following with a cured Shore A hardness of 35 minimum.
 - i. Mameco International: Vulkem 245
 - ii. Sonncbom: Sonolastic NP-2 Tremco Mfg. Co.: HPL Sealant Sika Corp.
 - iii. Sikaflex - 2c SL
 - b. For all other exterior applications:
 - i. Sikaflex 2 CNS or 15 LM, or one of the following providing that no staining of stone will result in their use.
 - ii. General Electric Corp.: Silpruf
 - iii. Dow Corning Corp.: 790 or 795.
 - c. For interior locations, other than floors, such as ceramic wall tile, plumbing fixtures and others where a mildew-resistant sealant is required:
 - i. General Electric Corp.: 1700
 - ii. Dow Corning Corp.: 786 d. Tape Sealants:
 - iii. Norton Specialties Plastics Div.: Norseal 770.
 - iv. Protective Treatments Inc.: PTI 606. Or equal.
 - d. Miscellaneous Materials:
 - i. Joint cleaner, primer and sealer: As recommended by the sealant manufacturer, for the surfaces to be cleaned, primed or sealed.
 - ii. Bond breaker tape: Polyethylene or other plastic tape specifically recommended by the sealant manufacturer to be applied to sealant contact surfaces where bond to the substrate or joint filler must be avoided for

proper sealant performance. Use self-adhering tape wherever possible.

- iii. Sealant backer rod: Compressible rod stock recommended by the sealant manufacturer.

B. Color:

1. Colors for each sealant installation will be selected by the Architect from standard colors normally available from the specified manufacturers. Should such standard color not be available from the approved manufacturer except at additional charge, provide all such colors at no additional cost to the owner.
2. In concealed installations, and in partially or fully exposed installations where so approved by the Architect, standard gray or black sealant may be used.

C. Primers:

Use only those primers which are non-staining, have been tested for durability on the surfaces to be sealed, and are specifically recommended for this installation by the manufacturer of the sealant used.

D. Backup Materials:

General: Use only those backup materials which are specifically recommended for this installation by the manufacturer of the sealant used, and which are nonabsorbent and nonstaining.

E. Acceptable types include:

1. Closed-cell resilient urethane or polyvinyl-chloride foam.
2. Closed-cell polyethylene foam.
3. Closed-cell-sponge of vinyl or rubber.
4. Polychloroprene tubes or beads.
5. Polyisobutyulene extrusions.
6. Oil-less dry jute.

F. Bond-Preventive Materials:

1. Use only one for the following as best suited for the application and as recommended by the manufacturer of the sealant used.
2. Polyethylene type, pressure-sensitive adhesive, with the adhesive required only to hold tape to the construction materials as indicated.
3. Aluminum foil.
4. Wax Paper

G. Masking Tape:

For masking around joints, provide masking tape conforming to Fed. Spec. UU-T-1 o6c.

H. Other Materials:

All other materials, not specifically described but required for complete and proper caulking and installation of sealants, shall be first quality of their respective kinds, new and as selected by the Contractor subject to the approval of the Architect.

2.2 ACCESSORIES

- A. Joint Cleaner, Primer, Backing Rods: As recommended by sealant manufacturers.
- B. Masking Tape: Non-staining, non-absorbent material compatible with sealants and surfaces adjacent to joints.

2.3 MIXES

- A. Comply with manufacturer's instructions.

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- B. Mix thoroughly with mechanical mixer without mixing air into sealants.
 - C. Continue mixing until sealant is uniform in color and free from streaks of unmixed materials.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Ensure that concrete and masonry have cured minimum of 28 days.
- B. Verify that sealant backing is compatible with sealant.
- C. Verify that substrate surface:
 - 1. **Is within manufacturer's moisture content range.**
 - 2. **Complies with manufacturer's cleanliness and surface preparation requirements.**
- D. Joint Width:
 - 1. **Verify joints are greater than minimum widths required by manufacturer.**
 - 2. **If joints are narrower than minimum required widths, widen narrow joints to indicated width.**
 - 3. **Do not place sealant in joints narrower than manufacturer's required minimum.**

3.2 PREPARATION

- A. Prepare, clean, and prime joints in accordance with manufacturer's instructions.
- B. Remove loose materials and matter which might impair adhesion of primer and sealant to substrate.
- C. Remove form release agents, laitance, and chemical retarders, which might impair adhesion of primer and sealant to concrete and masonry surfaces.
- D. Comply with ASTM C 1193.
- E. Protect elements adjoining and surrounding work of this Section from damage and disfiguration.
- F. Priming:
 - 1. **Prime joint substrates unless priming is not required by manufacturer's sealant-substrate compatibility and adhesion test.**

3.3 APPLICATION

- A. General:
 - 1. **Comply with results and recommendations from:**
 - a. "Manufacturer's compatibility and adhesion test.
 - 2. **Provide compatible sealant system between dissimilar assemblies and adjacent construction.**
 - 3. **Seal locations necessary to create and secure continuous enclosure even though Drawings may not indicate all locations; do not seal weep holes.**
 - 4. **Seal to prevent migration of water, vapor, and air through joints.**
 - 5. **Comply with manufacturer's required application temperature and relative humidity ranges. Consult manufacturer when sealant cannot be applied within these ranges.**
- B. Sealant Backing Bond Breaker:
 - 1. **Measure joint dimensions and size materials to achieve manufacturer-required width-to-depth ratios.**
 - 2. **Install to achieve sealant depth and sealant contact depth no greater than distance required by manufacturer for sealant material, joint width, and joint movement range.**
 - 3. **Install using blunt instrument to avoid puncturing.**
 - 4. **Install to provide optimum joint profile and in manner to provide not less than 6 mm (1/4 inch) sealant depth when tooled.**
 - 5. **Install tape where insufficient joint depth makes use of rod not possible. Match tape width to joint width to prevent three-side adhesion. Do not wrap tape onto sides of the joint.**
- C. Sealant:

1. **Install sealants at same time as installation of backing bond breaker materials.**
2. **Comply with manufacturer's requirements for applying different sealant materials in direct contact with each other.**
3. **Install sealant with pressure-operated devices to form uniform continuous bead.**
4. **Use sufficient pressure to fill voids and joints full.**
5. **Install to adhere to both sides of joint.**
6. **Install to not adhere to back of joint; provide sealant backing.**
7. **Install sealant free of air pockets and embedded matter.**
8. **Recess sealant 3 mm (1/8 inch) from surface of pavements and horizontal surfaces.**

D. Sealant Tooling:

1. **Comply with manufacturer's tooling method requirements.**
2. **Tool sealant within manufacturer's tooling time limits.**
3. **Remove excess sealant from surfaces adjacent to joint.**
4. **Allow acrylic latex sealant to achieve firm skin before paint is applied.**

3.4 SCHEDULE

A. Sealant Schedule:

1. **Exterior locations:**

- a. Wall joints: S-GP
- b. Perimeter of penetrations through walls: Designation S-GP
- c. Expansion joints in ceilings, soffits, and overhead surfaces: Designation S-GP
- d. Control joints and perimeter of penetrations in ceilings, soffits, and overhead surfaces: Designation: S-GP
- e. Wall and ceiling joints between frames and their rough opening: Designation S-GP
- f. Wall and ceiling joints between frames and adjoining surfaces: Designation S-GP
- g. Joints and perimeter of penetrations in horizontal pedestrian and vehicle traffic surfaces: Designation U-TB.
- h. Joints in Section 07 61 00: Designation S-GP.

2. **Interior Joints:**

- a. Wall and ceiling joints subject to movement: Designation U-MC.
- b. Wall and ceiling joints not subject to movement: Designation AL.
- c. Interior side of exterior openings: U-MC.
- d. Floor joints: Designation U-TB.]
- e. Wall and ceiling joints between frames and their rough opening: Designation AL.
- f. Wall and ceiling joints between frames and adjoining surfaces: Designation AL.
- g. Interior Sanitary Joints; Joints Between Plumbing Fixtures and Adjoining Floor, Wall, and Ceiling Surfaces; Joints in Dietary and Food Preparation Areas, Kitchens, Food Storage Areas, and Areas Subject to Frequent Wet Cleaning, including joints between walls and floors, Joints Between Back Splashes and Wall Substrates: Designation S-S.

END OF SECTION

08 11 00 – METAL DOORS & FRAMES**PART 1 GENERAL****1.1 QUALITY ASSURANCE**

- A. Conform to requirements of SDI-100.

PART 2 PRODUCTS**2.1 MANUFACTURERS**

- A. Acceptable Manufacturers – Welded Unit Frames: Subject to compliance with requirements indicated, provide products of one of the following:

- 1. Republic Builders Products.**
- 2. Ceco Corporation**
- 3. Fenestra Technologies Corp.**

- B. Acceptable Manufacturers – Hollow Metal Exterior Door:

- 1. Locknet. Owner's National Account. Refer to Scope of Work for contact information.**

- C. Substitutions: Under provisions of Section 01 32 19.

2.2 HOLLOW METAL FRAMES

- A. Exterior Frames: 14 gage thick material.
- B. Interior Frames: Welded steel, 16 gage thick material.
- C. Construction: Welded required; knocked-down not allowed.
- D. Corners of mitered design; stops coped and butted, or mitered.
- E. Guard Box: Closed box design, 26 gage minimum, welded to frame. Provide at:
- 1. Mortise hardware cutouts for assemblies installed within masonry walls or where assemblies have frame grouted with mortar or similar material at time of installation.**
- F. Spreader: Manufacturer's standard temporary channel or angles tack welded at bottom of jamb members.

- G. Floor Anchor Clips: Provide at each jamb and mullions which extend to floor.
- 1. In areas where concrete topping or other similar construction occurs, provide adjustable design to permit securing to depressed subfloor construction. In lieu of adjustable design, frames may extend to subfloor.**
- H. Jamb Anchors
- 1. Wood Stud Wall Systems: Anchor strap, type or design compatible with stud system. Locate at top of frame, 12 inches from top and, 24 inches on centers maximum intermittently, minimum 4 per jamb.**

2.3 DOORS

- A. Exterior Door: Refer to Drawings.
- B. Face Construction:
- 1. Interior:**
 - 2. Exterior: Face sheets broken to form and meet in joint on stile edges; weld and grind smooth joints on stile edges.**
- C. Vertical edges continuously reinforced from top to bottom with steel channels or flat bars placed immediately inside of face sheets. Vertical edges continuously reinforced from top to bottom with steel channels or flat bars placed immediately inside of face sheets.
- D. Reinforce top and bottom edge full width of door with steel channel not less than 16 gage.
- E. Fabricate exterior doors with top edge closed flush and fabricate bottom edge with flush closure where required for attachment of weatherstripping. Provide openings in bottom closure of exterior doors to permit escape of entrapped moisture.
- F. Provide insulating material in void spaces for sound deadening in assemblies utilizing internal core of steel stiffeners.
- G. Fill face welds and surface depressions with metallic paste filler or body putty, grind smooth and flush to unblemished finish appearance.

- H. Bevel lock or latch edge 1/8 inch in 2 inches at single doors and at meeting stiles at pairs of doors.
- I. Glazing Beads: Minimum 18 gage steel, screw on type, corners mitered, welded to door assembly on security side, removable on opposite side.
 - 1. **Factory install and secure loose bead with countersunk oval head screws spaced 8 inches on center maximum and within 2 inches of ends.**
 - 2. **Coordinate dimensions for glazing rabbets.**
- J. Vision Openings: Frame openings for sizes indicated.
 - 1. **Equip with glazing beads.**

2.4 FABRICATION

- A. Fabricate frames as welded unit.
- B. Fabricate doors and frames with hardware reinforcement plates welded in place. Provide mortar guard boxes.
- C. Prepare frame for silencers.

2.5 FINISH

- A. Interior Units: Baked on primer.
- B. Exterior Units: Baked on primer over 1.25 ounces per square foot galvanizing, in accordance with ASTM A 386.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install frames in accordance with SDI-105.
- B. Coordinate with gypsum board construction for anchor placement.
- C. Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

- D. Set frames plumb, level, and true alignment, securely fastened to the floor and adjoining walls.
- E. Install doors accurately in frames, maintaining specified clearances.

3.2 TOLERANCES

- A. Maximum Diagonal Distortion: 1/8 inch measured with straight edge, corner to corner.

END OF SECTION

08 71 00 – DOOR HARDWARE

1.1 QUALITY ASSURANCE

- A. Hardware Supplier: Company specializing in supplying commercial door hardware with 2 years of experience, with AHC designation.
- B. Hardware Installer: Employ a qualified carpentry person to perform the work of this Section.

1.2 REGULATORY REQUIREMENTS

- A. Conform to applicable building code for requirements applicable to fire rated doors and frames.
- B. Comply with provisions of Americans with Disabilities Act Accessibility Guidelines (ADAAG), ANSI A117.1, and applicable state and local requirements for accessibility, whichever is most stringent, to accommodate handicapped persons.

PART 2 PRODUCTS

2.1 GENERAL

- A. Provide hardware complete with necessary screws, bolts, anchors or other fastenings for proper application of suitable size and type, and match hardware as to materials and finish.

2.2 CYLINDERS

- A. Provide cylinders for locksets, deadlocks, exit devices, and other control and locking devices indicated in Hardware Sets.
- B. Equip cylinders with appropriate rings.
- 2. C. Finish cylinders and rings to match trim.

2.3 LOCKING AND LATCHING DEVICES

1. **Manufacturers: Refer to Drawings and Scope of Work.**
2. **Bored Locksets and Latchsets: ANSI A156.13, Grade 2.**
3. **Acceptable Products: Refer to Drawings.**

- 4. Backset: 2-3/4 inches.**
- 5. Latch Bolt: Two piece anti-friction, 3/4 inch throw.**
- 6. Strike: ANSI standard 4-7/8 inch height, 1-1/4 inch curved lip.**
- 7. Trim lever and rose: Refer to schedule at end of section.**

2.4 EXIT DEVICES

- A. Acceptable Manufacturers: Refer to Drawings.
- B. Basis for Design; Acceptable Products: Refer to Drawings.
- C. Standards: ANSI A156.3, Grade 1.
- D. UL listed for "Fire Exit Hardware" at labeled assemblies.
- E. Touch Bar: Modern design, recessed to provide proper clearance at door openings, full width of door.
- F. Dogging Feature: Equip for keyed cylinder at non-label assemblies.

2.5 SURFACE MOUNTED CLOSERS

- A. Acceptable Manufacturers: Refer to Drawings.
- B. Acceptable Products: Refer to Drawings.
- C. Standard: ANSI A156.4, Grade 1.
- D. Required Features: Manufacturer's standard cast iron or cast aluminum construction.
 - 1. Regular or parallel arm mounting.**
 - 2. Rack and pinion construction with compression spring, fully hydraulic.**
 - 3. Closing speed and latching speed controlled by independently operated valves.**
 - 4. Adjustable spring power allowing adjustment up to 50 percent in field to suit individual door conditions.**
 - 5. Adjustable backcheck for interior and exterior units.**

6. **Maximum operating force of 8.5 pounds for exterior doors, 5 pounds for interior doors, and 15 pounds for label doors.**
7. **Size as recommended by manufacturer for door size and weight.**
8. **Hold open and deadstop features where indicated in Hardware Sets.**
9. **Accessories: Manufacturer's standard full size non-metallic cover.**
10. **Furnish with necessary arms, tracks, brackets, plates, shoes, and other accessories to suit door and frame conditions.**
11. **Finish accessories to match cover.**

2.6 HINGES

- A. *Acceptable Manufacturers: Refer to Drawings.*
- B. *Butt Hinges:*
 1. **Comply with ANSI A156.1 and A156.7.**
 2. **Five knuckle design with square corners.**
 3. **Full mortise type.**
 4. **Flat button tip and matching plug.**
 5. **Non-removable pins for out-swinging exterior doors and for interior reverse bevel doors equipped with locking device; safety stud also acceptable. Non-rising pin for other doors.**
 6. **Non-ferrous construction at locations exposed to exterior atmosphere.**
 7. **Heavy weight for doors 3'-4" width and over and for fire rated doors over 8'-0" height. Standard weight at other doors.**
 8. **Anti-friction or ball bearing type for doors equipped with closers.**
 9. **Anti-friction or ball bearing type for doors (3'-0") width and over which are not equipped with closers.**
 10. **Plain bearing type for doors less than 3'-0" width which are not equipped with closers.**

C. Minimum Number Hinges:

1. **Doors 5'-0" or less in height: One pair.**
2. **Doors over 5'-0" and not over 7'-6": 1-1/2 pair.**
3. **Doors over 7'-6": One for each additional 2'-6" height or fraction thereof.**
4. **Dutch doors: 2 pair.**

D. Minimum Size and Gage:

1. **Doors 3'-0" width or less: 4-1/2 by 4-1/2 inches, 0.134 gage**
2. **Doors over 3'-0" up to 3'-4): 5 by 4-1/2 inches, 0.146 gage.**
3. **Doors over 3'-4": 5 by 4-1/2 inches, 0.190 gage.**
4. **Fire rated doors over 8'-0" height: Sized as indicated above, except not less than 0.180 gage.**

2.7 PUSH/PULL TRIM AND PLATES

A. Acceptable Manufacturers: Refer to Drawings.

B. Pulls and Push Plates:

1. **Acceptable Product: Refer to Drawings.**

C. Protection Plates:

1. **Type: Stainless steel, square corner design, 0.050 inch thickness.**
2. **Size: When mounted on push side of door, 1 inch less than door width at pair of doors and 2 inches less than door width at single doors. When mounted on pull side of door, 1 inch less than door width.**
3. **Kick Plates: Beveled 3 edges, 12 inch height unless indicated otherwise in Hardware Sets.**
4. **Armor Plates: Beveled 3 edges, 42 inch height unless indicated otherwise in Hardware Sets.**
5. **Mop Plates: Beveled 3 edges, 4 inch height.**

2.8 MISCELLANEOUS HARDWARE

- A. Acceptable Manufacturers: Refer to Drawings.
- B. Lock Guards: Prime coated steel, equivalent to Ives 184.
- C. Silencers:
 - 1. Type: Preformed neoprene or rubber.**
 - 2. Location and quantities:**
 - a. Pairs of Doors: Two at header.
 - b. Single Doors: Three at strike jamb.
 - c. Weatherstripped Doors: Not required.

2.9 WEATHERSTRIPPING, SEALS AND THRESHOLDS

- A. Acceptable Manufacturers and Products: Refer to Drawings.
- B. Thresholds:
 - 1. Type: Extruded aluminum.**
 - 2. Size: 5 inch width, 1/2 inch height.**
- C. Weatherstripping:
 - 1. Type: Extruded aluminum with neoprene bulb.**
- D. Sweep Strips:
 - 1. Type: Extruded aluminum with neoprene seal.**
- E. Door Bottom Seals:
 - 1. Type: Extruded aluminum housing with polyurethane seal.**
- F. Rain Drips:
 - 1. Type: Extruded aluminum.**
- G. Astragals:
 - 1. Type: Steel, prime coated.**

2.10 DOOR STOPS

- A. Acceptable Manufacturers: Refer to Drawings.

- B. Provide door stops at each door leaf, except not required at doors equipped with overhead stops/holders, or doors equipped with closers having deadstop feature.
- C. Door stops consist of floor stops or wall stops to prevent doors from striking building components or equipment.
- D. Wall Stops:
 - 1. **Equipped with expandable anchor for use at gypsum board/stud or wth machine screw and expansion shield for use at concrete or masonry walls.**
- E. Floor Stops:
 - 1. **Equip with machine screw and expansion shield, and appropriate riser where scheduled for areas indicated to receive carpet or thresholds.**

2.11 KEYING

- A. Door Locks: Keyed, master-keyed, and grand master-keyed as directed by Owner's Representative with control keying for core removable cylinders.
- B. Supply 2 keys for each lock.
- C. Provide bitting list locks.
- D. Supply keys in the following quantities:
 - 1. **10 master keys.**
 - 2. **10 construction keys.**

2.12 FINISHES

- A. Finishes:
 - 1. **US32D, brushed stainless steel, unless noted otherwise in schedule.**

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install hardware plumb, level, and true to line in accordance with manufacturer's templates, Section 01600, and Project conditions.
- B. Install fire rated hardware in accordance with NFPA 80.
- C. Where cutting and fitting is required on substrates to be field painted or similarly finished, install, fit, remove and store hardware prior to finishing. Reinstall hardware after finishing operations are completed.
- D. Do not install surface mounted items until finishes have been completed on substrate.
- E. Reinforce attachment substrates as necessary for installation and operation.
- F. For substrates which are not factory prepared for hardware:
 - 1. **Mortise work to correct size and location without gouging, splintering or causing irregularities in exposed finish work.**
 - 2. **Fit faces of mortised components snug and flush without excessive clearance.**
- G. Set thresholds at exterior doors in bed of sealant. Remove excess sealant.

3.2 ADJUSTING

- A. Check and adjust each operating hardware item to ensure correct operation and function.
- B. Ensure weatherstripping and seals do not inhibit closing and positive latching of door.
- C. Lubricate moving or operating components as recommended by hardware manufacturer.
- D. Use graphite type lubrication if none other is recommended.

- E. Replace defective materials or units which cannot be adjusted to operate as intended. Reinstall items found improperly installed.
- F. Prior to date of Substantial Completion, readjust and relubricate hardware items as necessary.

3.3 SCHEDULE – Refer to Drawings

END OF SECTION

09 21 16 – GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C 840, GA-201, GA-216 and GA-600.
- B. **CAL Green:** VOC Limit for adhesives (where used) is 50 per SCAQMD rule 1168.

1.2 DELIVERY, STORAGE, HANDLING

- A. Deliver, store, handle, and protect products in conformance with manufacturer's instructions and in accordance with Section 01 60 00.
- B. Store inside building, on sleepers, and out of water.

PART 2 PRODUCTS

2.1 MANUFACTURERS - GYPSUM BOARD

- A. Acceptable Manufacturers: Subject to compliance with requirements indicated, provide products of one of the following:
 - 1. **U. S. Gypsum.**
 - 2. **National Gypsum.**
 - 3. **Domtar Gypsum Co.**
 - 4. **Republic Gypsum Co.**
- B. Substitutions: Under provisions of Section 01 60 00.
- C. Specific product references are these of U.S. Gypsum Company unless noted otherwise as a standard of quality.

2.2 GYPSUM BOARD MATERIALS

- A. Regular Gypsum Board: ASTM C 36 type III, grade R; 48 inch by 1/2 inch thick, maximum permissible length; ends square cut, tapered and beveled edges.
- B. Moisture Resistant Gypsum Board: ASTM C 630; 48 inch by 1/2 inch thick, type C, maximum permissible length ends square cut, tapered edges.

2.3 TILE BACKING PANELS (where occurs at Tenant Improvements)

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Glass-Mat, Water-Resistant Gypsum Backing Board (alternate bid): ASTM C 1178/C 1178M.
1. **Acceptable Product: Subject to compliance with requirements, provide "Dens-Shield Tile Fireguard Type X" Tile Backer manufactured by G-P Gypsum, a Georgia Pacific Corporation company.**
 2. **Core: 1/2 inch.**
- C. Cementitious Backer Units (base bid): ANSI A118.9.
1. **Products: Subject to compliance with requirements, provide one of the following:**
 - a. Custom Building Products; Wonderboard.
 - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - c. United States Gypsum Co.; DUROCK Cement Board.
 2. **Thickness: 1/2 inch.**

2.4 ACCESSORIES

- A. U. S. Gypsum Company products specified below as a standard of quality, unless noted otherwise.
1. **Corner Beads: Metal, Durabead No. 103, galvanized.**
 2. **Casing Beads: No. 200-A, galvanized. 5. Control Joint: No. 093, galvanized.**
 3. **Hanger Wire: Annealed galvanized wire, of gauges indicated (or required to suit application) to rigidly support ceiling components in place.**
- B. Joint Treatment and Texture Materials
1. **Joint Tape:**
 - a. ASTM C 475 or FS SS-J-570, Type II, perforated tape.
 - b. Joint compound:
 - 1) ASTM C 475 or FS SS-J-570, Type I.
 - 2) Acceptable Product:
 - i) *Taping compound: USG Durabond Joint Compound Taping.*

PART 3 EXECUTION

3.1 CEILING FRAMING INSTALLATION

- A. Install in accordance with ASTM C 754, GA-201, GA-216, and GA-600 and manufacturer's instructions.
- B. Coordinate location of hangers with other work. Use 9 gage wire for single layer wall board, and 8 gage wire for double layer. Space at maximum 48 inches on center each way, unless ceiling framing occurs at more frequent intervals.
- C. Install ceiling framing independent of walls, columns, and above-ceiling work. Locate members within 6 inches of walls. Unless shown otherwise, use 1-1/2 inch cold-rolled channels, 2 inch on double layer board, at 48 inches off center main framing with furring channels at 24 inches on center, 16 inches on center for double layer board.
- D. Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 24 inches past each end of openings.
- E. Laterally brace entire suspension system.

3.2 GYPSUM BOARD INSTALLATION

- A. Install gypsum board in accordance with GA 201, GA 216, GA-600 and U.S.G. "Gypsum Construction Handbook".
- B. Erect board vertically, except that board may be erected horizontally for curved walls, with ends and edges occurring over firm bearing. Stagger end joints to occur at different locations on opposite sides of wall. Apply board to suspended ceilings with long dimension at right angles to framing.
- C. Use screws when fastening gypsum board to metal furring or framing and nails to wood studding. Stagger fasteners opposite each other on adjacent ends and edges. Space fasteners as recommended in U.S.G., "Gypsum Construction Handbook".
- D. Double Layer Applications: Use gypsum backing board for first layer, placed perpendicular to framing or furring members. Use fire rated gypsum backing board for fire rated partitions. Place second layer parallel to first layer. Offset joints of second layer from joints of first layer.

- E. Install cementitious backing board over stud framing in accordance with manufacturer's instructions.
- F. Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum ceiling board with sealant.
- G. Place control joints at changes in back-up material, at maximum 20'-0" off center in exterior walls, and at maximum 30'- 0" off center at interior partitions. In ceilings, install at maximum 30'-0" off center each way. Provide fire resistant protections behind control joints in fire rated assemblies.
- H. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
- I. Thicken partitions to eliminate wall surface jogs for the full length of the wall within a room to conceal structural members, pipes, panels, specialty items, and accessories.
- J. Coordinate door and other frame thicknesses as required.

3.3 JOINT TREATMENT

- A. Tape, fill, and sand exposed joints, edges, and corners to produce surface ready to receive finishes. The intent is to provide the highest quality of joint treatment work consistent with commercial construction. Leave surfaces smooth, uniform, and free of fins, depressions, ridges, cracks, and other imperfections.
- B. Feather coats onto adjoining surfaces so that camber is maximum 1/32 inch.
- C. Levels of Finish:
 - 1. **Comply with GA-214; italicized commentary is excluded; replace words "may" and "should" with "shall."**
 - 2. **Locations to receive Level 4 finish: Areas to be painted.**
 - 3. **Locations to receive Level 3 finish: Areas to receive moisture resistant gypsum board used as a tile substrate.**
 - 4. **Locations to receive Level 2 finish: Fire-rated , sound-rated, and smoke-rated assemblies in ceiling plenums and concealed areas.**

5. Locations to receive Level 1 finish: Non-fire-rated , non-sound-rated, and non-smoke-rated assemblies in ceiling plenums and concealed areas.

3.4 TOLERANCES

- A. Maximum Variation from True Flatness: 1/8 inch in 10 feet in any direction.

09 22 00 Portland Cement Plaster (Stucco)

PART I –GENERAL

1.01 SUMMARY

- A. Provisions of Division 01 apply to this section
- B. Section Includes:
 - 1. Water-resistive barrier (WRB)
 - 2. Lath and Portland cement plaster or (“Stucco”) as indicated on drawings.
 - 3. Portland cement scratch coat as a substrate for ceramic wall tile.

1.02 DEFINITION

- A. Three coat (7/8 inch) Plaster Assembly over Framing:
Silicone core/fiberglass face or wood based sheathing (per APA) exterior sheathing board, with one sheet of a self-adhered flashing (SAF) applied at all horizontal surfaces, under two sheets of black grade “D” building (kraft) paper as a weather-resistive barrier, galvanized plaster accessories, metal lath, a conventional plaster scratch and brown coat meeting ASTM Standard C 926, with an integrally colored finish.
- B. Two-Coat (5/8 inch) plaster over CMU substrate:
A 3/8” to 1/2” ASTM C 926 Basecoat directly applied to properly-prepared concrete masonry units, with an integrally colored finish. A metal lath (no WRB) is required for applications over 5/8 inch thick.

1.03 DESIGN REQUIREMENTS

- A. Provide Portland cement plaster assemblies meeting International Building Code (IBC), American Society of Testing Materials (ASTM) and Technical Services Information Bureau (TSIB) requirements and/or recommendations for a nominal 7/8 inch cement plaster.
- C. Contractor shall install a complete portland cement plaster “stucco” assembly including all the equipment, materials and labor necessary as indicated on drawings.
- D. Contractor shall not assume design authority and shall request and/or inform Architect of any design deficiencies that may have a deleterious effect on the plaster assembly.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer’s data sheets of all products to be installed, describing product size, finish and verify compliance with code or approval (i.e., ICC Evaluation Report.). Do not proceed until submittals are approved in writing by Architect.
- B. Samples: Submit actual samples of all trim accessories to be installed (control joints, expansion joints, corner reinforcement, reveals and screeds)
- C. Substitution Requests: Material or product substitutions will not be reviewed without a written cover statement from contractor explaining why and how the substitution will benefit the owner, including cost impact or savings, time impact or savings, warranty impact and service life. Reference letters are recommended.
- D. Certificates: Provide certificates of any proprietary materials and/or systems to be installed for the product and that contractor is approved by manufacturer to install that product.
- E. Submitted sample: Contractor to submit a 24 inch x 24 inch sample of Portland cement plaster with representative sample of workmanship, color and texture. Once approved by Architect, sample shall remain on project site for reference until project is complete.
- F. Site Mock-Up: Contractor shall install a mock-up on site that includes and demonstrates cement plaster to window transition with a flashing a penetration. In addition or may be same mock-up a

control or expansion joint installation. The site mock may be part of the building, do not proceed until Architect has approved the flashing procedure. Do not alter from the established procedure unless approved by Architect.

1.05 QUALITY ASSURANCE

- A. Contractor shall be licensed, bonded and financially sound to complete project.
- B. Contractor shall meet the following requirements:
 - 1. Specialize in the scope of work, Lathers and Plasterers employed shall have completed a State-approved apprenticeship program for Lathing and Plastering. Apprentices shall be currently enrolled in such program.
 - 2. Contractor shall be able to meet scheduling requirements set at time of bid.
 - 3. Document experience in quality work of similar scope.
 - 4. Member in good standing of the Western Wall and Ceiling Contractors Association (www.wwcca.org) or have a verified state approved apprenticeship program for lathers/plasterers.
- C. Comply with the following Standards:
 - 1. ASTM C 1063- Installation of Lathing and Furring to Receive Portland Cement Plaster
 - 2. ASTM C 926- Application of Portland Cement Plaster
 - 3. International (or local) Building Code (most current edition)
 - 4. Technical Service Information Bureau (TSIB) Technical Bulletins and "Plaster Textures & Acrylic Finishes" brochure.
 - 5. Manufacturer's recommendations of products used.
 - 6. Plaster Assemblies Manual (most current edition)
- D. Inspection: TSIB may be requested to provide visual walk of completed lath prior to application of cement. WWCCA Contractor agrees to follow any and all recommendations directed by the TSIB. WWW.TSIB.ORG
- E. OSHA and/or CAL/OSHA requirements where apply

PART 2 – PRODUCTS

2.01 SHEATHING

- A. Comply with Division 9 Section "Gypsum Sheathing".
- B. Wood-based sheathing: to comply with Engineered Wood Association (APA)

2.02 LATH AND RELATED ACCESORIES

- A. Water-resistant barrier (WRB) shall be minimum 60 minute water resistive Grade D and comply with Fed. Spec. UU-B-790a. Alternate WRB must be approved by the Architect.
- B. Self Adhered Flashing (SAF) must be compatible with the WRB, minimum 25 mils thick, self sealing and waterproof. Alternates must be approved by Architect.
- C. Cold-Rolled Channel (CRC): 1 ½ inch and ¾ inch with a minimum of 33,000 psi yield strength and a minimum of .0538 inch bare steel thickness, comply with ASTM A 653.
Note: For suspended soffits and ceilings use 1½ inch CRC as main carrying channels and ¾ inch CRC as cross furring.

use.

1. Expanded metal: Galvanized diamond mesh, 3.4 lbs/sy, self-furred, complying with ASTM C 847 (For metal framing, concrete and/or masonry substrates)
 2. Woven Wire: Galvanized, self-furred, 17 gage with openings not to exceed 1½ inch, complying with ASTM C 1032. Not for use on cold formed framing, concrete or masonry substrates. (For wood framed walls).
 3. Welded Wire: Galvanized, self-furred, 17 gage with openings not to exceed 1 ½ inch, complying with ASTM C 933. Not for use on ceilings (unless specifically designed), concrete or masonry substrates. Maybe used over metal framed walls provided the product is specifically designed for that purpose.
- E. Lath Accessories: Steel accessories to conform with ASTM C 653, aluminum from extruded alloy 6060 T5.
1. Foundation Weep Screeds: Minimum 26 gage galvanized steel with a 3 ½ inch attachment flange. Must be type that is designed to allow moisture to weep out. Industry generic name- #7 Weep Screed.
 2. Control Joints: Single-piece minimum 26 gage galvanized steel with a flange designed to engage plaster. Grounds to provide full 7/8 inch thickness of cement plaster. Industry generic name- XJ -15
 3. Expansion joint: Two-piece joint designed to allow for movement in multiple directions. Made from aluminum or galvanized steel (see drawings for profile and material designation) Industry generic name- #40 2-piece joint.
 4. Drip Screed: Minimum 26 gage galvanized steel with ground and holes to allow for drainage. Industry generic name #10 Drip.
 5. Casing Beads: Minimum 26 gage galvanized steel with 7/8 inch grounds. Expanded flange casing beads to be approved by Architect. Industry generic names: Milcor, J-mold or #66.
 6. Reveals: Size, shape and profile as designated on drawings. Actual sample must be submitted for approval. Aluminum reveals shall have 4 – way intersections shall be factory mitered. Contractor to use intersection and termination clips as supplied by manufacturer.
 7. Corner reinforcement: Welded wire corners made from galvanized steel. Square or “Bullnose” as per drawings. Plastic or (PVC) nose bead shall be used when an acrylic finish coat is used in lieu of a cement finish coat.
 8. “Butterflies”: 5 inch by 16 inch strips of metal lath or cornerite. Or strips of fiberglass reinforcing mesh embedded into base/skim coat. As an alternate, furring nails/screws around doors and windows. (Select one)
 9. Fasteners: All fasteners shall be corrosion resistant, delivered in sealed packages and clearly labeled
 - a. Wire: shall be galvanized annealed and 18 gage or 16 gage as appropriate for use, comply with Federal Spec. FSQQ-W-461g.AS.
 - b. Screws: Wafer head “lathers” Type S with length that penetrates steel not less than 3/8 inch or into wood framing 5/8 inch Comply with ASTM C 1002 and/or ASTM C 954
 - c. Nails: Galvanized 11 gage with a 3/8 inch diameter head and a length to penetrate wood framing (exclusive of sheathing) minimum ¾ ”inch. Comply with FS FF-N-105 penetrate wood framing (exclusive of sheathing) minimum 3/4 inch. Comply with FS-FF-N-105.
 - e. Powder Actuated Fasteners: for concrete and masonry substrates only. Comes with a factory washer (disc) and shall have manufacturer’s recommendation for the specific use intended. Must demonstrate a minimum 50 pound pull out value, not less than ¾ inch long and is a head diameter of 3/8 inch wide.

2.03 PLASTER AND RELATED MATERIALS

- A. Portland Cements:
1. "Common" Cement Type I/II or III , Comply with ASTM C 150
 2. Masonry Cement , Comply with ASTM C 91
 3. Plastic Cement, Comply with ASTM C1328
 4. Proprietary Blended Basecoats must demonstrate compliance with ASTM C 926 and provide a manufacturer's warranty
- B. Lime: Hydrated and Type S and complying with ASTM C 206
- C. Sand: Washed, free of deleterious or friable material and well graded, conforming to ASTM C 897 or demonstrate sand has a successful performance of at least five (5) years.
- D. Water: Clean and potable
- E. Additives to the basecoat:
1. Fibers: ¼ to ½ inch long alkali resistant, polypropylene, nylon or fiberglass, complying with ASTM C 1116
 2. Pumping Additive: May be used when approved by Architect and only with a letter from manufacturer that the pump additive will have no deleterious effect on the plaster mix.
 3. Other Additives (air-entrainers, water reducers, accelerators and alternate plasticizers): not permissible unless approved by Architect.
- F. Basecoat Mix Proportions: Contractor shall select one of the following approved mix ratios and not alternate, switch or modify through the duration of the project unless approved by architect, follow TSIB recommendations: Scratch coat may be slightly richer in cement than brown coat: Proportions are listed in parts per volume. Sand is parts per "sum" of cementitious materials, lime is considered a cement. Fibers may be added to all mixes except proprietary basecoats. Pumping aids may be used if manufacturer's recommendations are closely followed. Quantities are volume and in parts:
- Option #1 -**
Field Mix: Conforming to ASTM C 926, Table 3
- Option #2**
Proprietary Basecoat: Follow all manufacturers' recommendations to ensure warranty
- G. Finish Coat: Refer to drawings for Cement or Acrylic Finish Coat. (Architect to select "cement" or an "acrylic" finish and note on elevations. Architect to Select one:
1. Cement Finish: Pre-blended and bagged by a manufacturer member of the Stucco Manufacturers Association (SMA). Cement finish shall be pre-blended base material with pre-packaged color boxes (if required). Texture and color selection by Architect: (Select One and Note on Elevations)
 - a. Sand Finish (16-20)
 - b. Light machine "Dash"
 - c. Lace or Spanish trowel
 - d. Semi-smooth- (Santa Barbara or Mission) – shall include a polymer basecoat compatible with the cement finish coat.and fiberglass mesh over the brown coat.

2. Acrylic Finish: Pre-blended and colored by a manufacturer that is a member of EIMA or the SMA. Texture and color selection by Architect: (Select one and note on elevations)
 - a. Sand Finish (fine, medium, coarse)
 - b. Putz or Swirl
 - c. Semi-smooth finish
 - d. Natural Stone Aggregate
 - e. Ceramic bead finish
 - f. Metallic finish
 3. Use a primer coat for the acrylic finish to ensure color uniformity and 100% coverage on lighter colors and all putz finish or swirl finishes.
 4. Fog coat manufactured by manufacturer for cement finish to ensure color uniformity (as needed)
 5. Bonding agent (if required), non re-emulsifying type, designed specifically for exterior portland cement plaster.
- H, Architectural EPS Foam Shapes (Optional): Shall conform to ASTM C-578 type 1, flame spread index 25 or less, smoke generated 450 or less as tested in accordance with ASTM E 84. Size, shape and thickness is as indicated on drawings or details.

PART 3 –EXECUTION

3.01 EXAMINATION

- A. Verify that substrate and/or framing is complete and adequate to support lath and a portland cement plaster before starting work. Notify Architect, Owner or General Contractor of any unsatisfactory conditions. Proceed as directed.
- B. Clarify questions about details and inform Architect of conditions not to industry or TSIB standards. Proceed as directed.
- C. Do not cover wet materials, i.e. wood, gypsum sheathing.

3.02 WATER RESISTIVE BARRIER (WRB) INSTALLATION

- A. General: Install two (2) layers WRB over all sheathings.
 1. Individual layer (single layer) method is stated practice of the ICC over wood sheathing. Double layer or fifty percent method/s are acceptable if permitted by the local building official.
 2. If synthetic “house wraps” are substituted for one of the layers of WRB, the asphaltic layer should be the top layer to act as a bond breaker for the scratch/base coat.
- B. Integrate with flashings to always create a “weatherboard” or “Shingle-Fashion”, i.e. upper layer always overlap lower layers.
- C. Install WRB with a minimum two (2) inch horizontal laps and six (6) inch vertical laps. WRB is not required on ceilings or soffits.
- D. Repair holes, tears or rips as recommended by the TSIB.
- E. A Self Adhered Flashing (SAF) shall be used under the cement plaster in any locations where the plaster will be in less than a 60° plane or where water can pond. Apply SAF and WRB in a “Shingle Fashion”.
- F. A WRB (building paper or “housewrap”) is not to be applied over concrete and/or masonry substrates. Liquid applied or trowelable products (if required) are to be reviewed by Architect prior to installation.
- G. Cement plaster shall not be installed in a horizontal position and subject to water ponding. The surface and framing shall be sloped and have a layer of SAF to extend over the WRB to six (6) inches onto the vertical wall surface.

3.03 LATH AND TRIM ACCESSORY INSTALLATION

- A. Install trim accessories, i.e. weep screeds, casing beads, reveals, drip molds, corner reinforcement and control/expansion joints plumb, level and straight. All intersections and terminations shall be neatly mitered and align with adjoining trims. The grounds shall be set to provide specified plaster thickness.
- B. Install longest length possible. It is recommended not to use pieces shorter than six (6) feet in length.(i.e. a 12 foot opening shall have two(2) six 6' (foot) pieces.) Ends of lath should be staggered.
- C. Attach trim accessories to remain firm and solid during plastering. Attachment should not exceed 24 inches on center.
- D. Single-piece Control Joints may be placed over continuous lath and wire tied to lath. Two-piece Expansion Joints must have the lath cut, be attached to framing and lath lap the flanges. Expansion joints govern over control joints (i.e. control joints shall terminate into expansion joints).
 - 1. Place control joints as indicated on elevations. Typically this will be at corners of window and door openings. Panels should be as square as possible and should not exceed 144 square feet in size (unless otherwise noted on plans)
 - 2. WRB shall be continuous behind all control joints and vertical reveals.
 - 3. Horizontal reveals or two-piece expansion joints “may” have the WRB lap over the upper nail flange of the reveal. When this method is used; the WRB must extend up from below the horizontal reveal continuous behind and up past the reveal a minimum of six (6) inches. The upper layers of WRB lap over the nail flange.
- E. Walls subject to wind-driven rain shall have the trim accessory terminations, intersections and miters embedded in a daub of sealant.
- F. Expanded flange casing shall be allowed over concrete and/or masonry substrates.
- G. Apply metal lath horizontally across framing or furring supports and lap lath a minimum 1/2 inch at sides and minimum 1 inch on ends. Lap wire lath minimum one mesh on sides and ends. Stagger vertical laps at least 16 inches. Do not lap WRB over lath (no cold joints).
- H. Lath shall lap flanges of solid flanged trim accessories by a minimum of 50%..
- I. Attach lath to framing supports not more than seven (7) inches apart along framing supports only.
- J. Powder Actuated Fasteners shall be used on concrete/masonry substrates when lath is applied. Fasteners shall be driven home and avoid spalling of concrete. Pattern shall simulate that of framed walls. Fasteners shall have a minimum 50 lb “pull out” value.

3.04 SOFFITS AND CEILINGS

- A Refer to section 09100 –Suspended plaster ceilings

3.05 PLASTER INSTALLATION

- A General: Areas not to be plastered shall be protected and/or kept clean and free of cement. Basecoat shall be plumb and level, tolerance shall be ¼ inch in ten (10) feet. Texture and color shall match mock-ups.
- B. Concrete/masonry substrates: Contractor to determine if substrate is an acceptable for plaster bonding and if a bonding agent is required. Test patches are recommended. If substrate is questionable, notify Architect and proceed as directed.
- C. Ceramic Tile: Plasterer to provide a scratch coat (only) for the tile contractor. Wipe down all interior and exterior corners. Do not use additives that may impair bond of mortar bed for tile.
- D. Cement plaster to be applied with hand tools or machine at contractor’s option (Best Means & Methods).
- E. Do not mix more plaster that can be used in 30 minutes. Do not re-temper. Add only enough water allow proper application of cement plaster.
- F. Verify lath is complete, substrates sound and solid prior to plastering.

3.06 SCRATCH COAT

- A. Apply from architectural break to architectural break with sufficient pressure to ensure keying into lath. No cold joints shall be allowed.
- B. Apply in sufficient thickness to substantially cover the lath.
- C. Immediately score (scarify) in a predominately horizontal direction.
- D. Wipe down all corners and leave no cement protrusions that will interfere with application of brown coat.
- E. (OPTION) Place “butterflies” of alkali-resistant fiberglass mesh in a diagonal direction, delicately onto fresh scratch coat at the apex of window and door penetrations.
- F. Let scratch coat cure 48 hours and moist cure with water. Contractor will determine moist-cure procedures based on climate conditions.
- G. Keep scratch coat hydrated. Follow ASTM and/or TSIB recommendations for curing.
- H. Do not apply brown coat until scratch coat is firm and hard.

3.07 BROWN COAT

- A. Pre-wet the scratch coat or concrete/masonry substrate (if required) to avoid excessive suction of moisture from brown coat to avoid accelerated evaporation.
- B. Apply from architectural break to architectural break. No cold joints will be allowed.
- C. Brown coat shall be applied and fill to the grounds. Surface to be immediately darbied and/or rodded to a level and plumb plane.
- D. When the initial moisture has left brown coat, “hard” float the brown coat to “densify”, consolidate and prepare for a finish coat. Sponge floats are not acceptable. A hard float shall be considered made from wood shingle, cork, plastic, compact felt or neoprene.

3.08 ALTERNATE METHOD

- A. Building codes and standards recognize the “alternate” method or “double-back” application method to apply the brown coat.. This is acceptable only after approval from Architect.
- B. The brown coat may be applied to the scratch coat as soon as the scratch coat has attained sufficient rigidity to allow brown coat application if the application does not fracture the scratch. On sheathed construction, the brown can be applied the same day at contractor’s option. Hard floating and curing still applies.

3.09 CURING

- A. It is important to keep cement basecoat hydrated and allow the cement to chemically cure and harden. Moist cure as needed, morning and evening as required to produce a hard basecoat. Refer to TSIB recommendation.
- B. Basecoat shall be allowed to cure a minimum of seven (7) days before applying a finish coat. If feasible allow the basecoat to cure fourteen (14) days prior to applying the finish coat.
- C. Plastered walls with excessive shrinkage cracks in the basecoat due to a failure to water cure shall be skim coated with a polymer-based cement coat prior to applying a finish coat.

3.10 FOAM SHAPE INSTALLATION:

- A. Adhesively attach the shapes to the properly-cured base as noted on drawings with adhesive recommended by shape’s base coat and finish manufacturer and allow to fully cure.
- B. Apply acrylic base coat and fully embed 4 oz. fiberglass mesh into wet base coat.
- C. Specified Finish must be compatible with basecoat.

3.11 FINISH COAT

- A. Apply finish coat to match mock-ups in color and texture.
- B. Acrylic finish coat (delete if not applicable): apply a primer coat for light colored finishes or provide full prime coverage for all “putz” or “swirl” textures, Natural Stone Aggregate and Ceramic-bead textures.
- C. Provide sufficient crew size to maintain a wet edge. Scaffold lines should be kept to a minimum.
- D. Maintain consistency and uniformity in application procedures and techniques.
- E. Leave adjacent surfaces clean and free of plaster (stucco).
- F. Leave protection of the plaster in place until finish coat is set.
- G. Repair scaffold tie-ins to maintain water-resistance of plaster assembly and blend with finish coat.

3.12 QUALITY CONTROL

- A. Finish tolerance shall be $\frac{1}{4}$ ” in ten (10) feet. No “eye-catching” discrepancies shall be allowed.
Refer to TSIB Technical bulletin on “Judging Exterior Plaster”.
- B. Avoid performing work that will result in patching.
- C. In the event of a dispute over quality or an installation, the architect shall call on the TSIB.
Contractor agrees to abide by TSIB decision for repair, alteration or remedy.

09 22 01 Exterior Stucco Finishes

BMI Natural Base, BMI White Base

Description

BMI Natural Base and BMI White Base are cement based products for a permanent decorative finish over exterior surfaces. Material is factory prepared using raw ingredients that meet or exceed ASTM specifications. BMI exterior stucco is prepared in natural base, white base and in any standard color chart or can be custom color matched upon request. Texture available in Float 16/20, Texture 20/30, Marble, Dash, 20 mesh, 30 mesh, or upon job specification.

Preparation:

The brown coat shall be a uniform properly prepared Portland cement based substrate. The brown coat should be moist cured for at least 48 hours and allowed to dry completely for a minimum of 7 days.

Mixing:

Exterior stucco finish shall be power mixed with clean water for at least 15 minutes to assure complete hydration. Do not attempt to temper material that has started to set. Under most conditions, a batch will not start to set up for 90 minutes.

Application:

Finishes shall be 1/16" to 1/8" thick.

Hand application:

Apply using trowel. Spread on even coat then rubber float (sand finish) or trowel to desired texture.

Gun Application:

Spray first coat over dry surface and cover base coat completely. After first coat has dried, spray second coat in thinner consistency and bring to the desired texture. During periods of hot and dry weather, lightly mist with clean water. BMI exterior stucco finish will normally dry and set the same day. Final hardness will be reached in 28 days.

Do not apply with temperature below 40 degrees F.

Coverage

Coverage's are affected by method of application, existing surface conditions and the texture desired.

Approximate coverage's per 90 lb bag are:

Finish	Area
Sand/Float	12-16 sq yds
Lace/Texture	10-14 sq yds
Machine/Dash	8-12 sq yds
Smooth/Marble	14-18 sq yds

Specifications

Material Standards

- Hydrated Type-S Lime: ASTM C-206
- White Portland Cement: ASTM
- C-150 Type I
- BMI Exterior Stucco Finish: Conforms to ASTM C-926 Recommendations

09 22 16 – NON-STRUCTURAL METAL FRAMING

PART 10GENERAL

1.RELATED DOCUMENTS

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

2.SUMMARY

- a.Section Includes:

- 1)Non-load-bearing steel framing systems for interior gypsum board assemblies.
- 2)Suspension systems for interior gypsum ceilings, soffits, and grid systems.

- b.Related Requirements:

- 1)Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and roof rafters and ceiling joists.
- 2)Section 054400 "Cold-Formed Metal Trusses" for roof trusses.

3.ACTION SUBMITTALS

- a.Product Data: For each type of product.

4.INFORMATIONAL SUBMITTALS

- a.Evaluation Reports: Submit evaluation reports certified under an independent third party inspection program administered by an agency accredited by IAS to ICC-ES AC98, IAS Accreditation Criteria for Inspection Agencies.
- b.Manufacturer's Certification: Submit manufacturer's certification of product compliance with codes and standards along with product literature and data sheets for specified products.

5.QUALITY ASSURANCE

- a.Contractors shall provide effective, full time quality control over all fabrication and erection complying with the pertinent codes and regulations of government agencies having jurisdiction. Conduct pre-installation meeting to verify project requirements, substrate conditions, and manufacturer's installation instructions.

6.DELIVERY, STORAGE, AND HANDLING

- a. Notify manufacturer of damaged materials received prior to installation.
- b. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- c. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI's "Code of Standard Practice".

PART 11 PRODUCTS

1.PERFORMANCE / DESIGN CRITERIA

- a. STC-Rated Assemblies: For STC-rated demising wall assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- b. Design framing systems in accordance with American Iron and Steel Institute Publication "North American Specification for the Design of Cold-Formed Steel Framing – Non-Structural Members", except as otherwise shown or specified.
- c. Design loads: As indicated on the Architectural Drawings or 5 PSF minimum as required by the California Building Code.
- d. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection recommended by the manufacturer as well as code compliance criteria.

2.FRAMING SYSTEMS

- a. Framing Members, General: Comply with ASTM C 645 for conditions indicated.
 - 1) Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2) Protective Coating: Comply with ASTM C 645; roll-formed from hot-dipped galvanized steel; complying with ASTM A 653/A 653M G40 (Z120) or having a coating that provides equivalent corrosion resistance. A40 galvanized products are not acceptable.
 - a) Coatings shall demonstrate equivalent corrosion resistance with an evaluation report acceptable to the authority having jurisdiction.
- b. Studs and Runners: ASTM C 645.
 - 1) Non-Structural Studs: Cold-formed galvanized steel C-studs as per ASTM C 645 for conditions indicated below:
 - a) Flange Size: as specified on drawings.
 - b) Web Depth: [As specified on Drawings]

- 1)Minimum Thickness: 0.0150 inches (0.3810 mm).
- 2)Design Thickness: 0.0158 inches (0.4013 mm).

c)Member Description: ProSTUD 20 (20 EQ) 65 ksi.

- 1)Minimum Thickness: 0.019 inches (0.4826 mm).
- 2)Design Thickness: 0.0200 inches (0.5080 mm).

d)Member Description: ProSTUD 30 mil (20 DW) 33 ksi.

- 1)Minimum Thickness: 0.030 inches (0.760 mm).
- 2)Design Thickness: 0.0312 inches (0.792 mm).

e)Member Description: ProSTUD 33 mil (20 STR) 33 ksi.

- 1)Minimum Thickness: 0.033 inches (0.8382 mm).
- 2)Design Thickness: 0.0346 inches (0.879 mm).

2)Non-Structural Track: Cold-formed galvanized steel runner tracks, drywall track, in conformance with ASTM C 645 for conditions indicated below:

- a)Flange Size: 1-1/4 inch (32 mm).
- b)Web Depth: Track web to match stud web size.
- c)Minimum Material Thickness: Track thickness to match wall stud thickness or as per design.

3)“EQ” (Equivalent Gauge Thickness) Steel Studs and Runners: Members that can show certified third party testing with gypsum board in accordance with ICC ES AC86 (Approved May 2012) need not meet the minimum thickness limitation or minimum section properties set forth in ASTM C 645. The submission of a recognized evaluation report is acceptable to show conformance to this requirement.

4)Steel Framing Stud and Track Wall System: Self-locking metal studs, and telescoping stud extensions and tracks.

5)Steel Framing Stud and Deflection Track Wall System: Self-locking metal studs with telescoping stud extension with knockout in each flange to allow for 1/2 inch of deflection for fire-rated head-of-wall deflection system.

- a)Minimum Base-Metal Thickness: [0.0179 inch (0.45mm)] [0.0237 inch (0.60mm)] [0.0296 inch (0.75mm)] [0.0329 inch (0.84mm)].
- b)Depth: [2-1/2 inches (64mm)] [3-5/8 inches (92mm)] [4 inches (102mm)] [6 inches (152mm)].

c.Sip-Type Head Joints: Where indicated, provide **one of** the following:

1)Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and **[with continuous bridging and spacer bar]** **[with manufacturer's proprietary bridging and spacer bar]** **[cold-formed channel with clip angles]** located within 12 inches (305 mm) of the top of studs to provide lateral bracing.

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- 2) Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
- 3) Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- d. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- e. Control Joint Backer: Metal profile which supports intumescent materials located inside and spanning gap between opposing drywall edge at control joint locations.
- 1) 0.018 inch (0.45mm) x 3-1/4 inch (82.6 mm) width.
- f. Backing Plate: Proprietary fire-resistance-treated blocking and bracing in width indicated.
- h. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
- 1) Minimum Base-Metal Thickness: **[As indicated on Drawings]**
- i. Channel Bridging and Bracing: Steel, 0.0538-inch (1.37-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
- 1) Depth: **[As indicated on Drawings]**
- j. U-Channel Bridging: Steel, 0.0538-inch (1.37-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
- 1) Depth: **[As indicated on Drawings]**
 2) Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.0538-inch- (1.37-mm) thick, galvanized steel.
- k. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
- 1) Minimum Base-Metal Thickness: **[As indicated on Drawings]**
 2) Depth: **[As indicated on Drawings]**
- l. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
- 1) Configuration: Asymmetrical.
- m. Carrying Channels: 0.0538-inch (1.37-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
- 1) Depth: **[As indicated on Drawings] [3/4 inch (19 mm)] <Insert depth>**.
 2) Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.0296 inch (0.75 mm).
 3) Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

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- n. Z-Shaped Furring: With slotted or non-slotted web, face flange of **1-1/4 inches (32 mm)**, wall attachment flange of **7/8 inch (22 mm)**, minimum uncoated-metal thickness of **0.018 inch (0.45 mm)**, and depth required to fit insulation thickness indicated.
- o. Radius Framing: Steel sheet runner for non-load-bearing curves, bends, variable radii and arches using a work-hardened steel base strip.
- 1) Minimum Base Metal Thickness: **[As indicated on Drawings]**
 - 2) Depth: **[As indicated on Drawings] [2-1/2 inches (63.5 mm)] [3-5/8 inches (92.1 mm)] [6 inches (152.4 mm)] <Insert depth>**.
- p. Headers and Jambs: Manufacturer's proprietary shape used to form header beams and jambs, columns or posts, of web depths indicated, unpunched, with stiffened flanges and as follows:
- 1) Minimum Base Metal Thickness: **[As indicated on Drawings]**
 - 2) Web and Flange Widths, Type HDS: **[3-5/8 by 3 by 1-1/16 by 3/4 inch (92.1 by 76.2 by 27.0 by 19.1 mm)] [6 by 3 by 2-1/4 by 3/4 inch (152 by 76.2 by 57.2 by 19.1 mm)]**.
 - 3) Web and Flange Widths, Type HDSC: **[3-1/2 by 3-1/16 by 2 inches (88.9 by 77.8 by 50.8 mm)] [5-7/8 by 3-1/16 by 2 inches (149 by 77.8 by 50.8 mm)]**.
- q. Framed Openings: Galvanized steel one piece header and jamb studs meeting or exceeding the requirements of ASTM C 754 for conditions indicated below.
- 1) Header Clip: **[RedHeader RO Drop 'N Lok Clip][HDSC]**.
 - a) Attachment screw pattern per manufacturer's printed literature.
 - 2) Header Flange Length: **3 inch (76 mm) HS300 flange.**
 - 3) Jamb Flange Length: **3 inch (76 mm) HS300 flange.**
 - 4) Minimum Yield Strength: **33ksi (227 MPa).**
 - 5) Minimum Material Thickness: **[33 mil (20 gauge) (0.0329 inches)] [43 mil (18 gauge) (0.0428 inches)]**
- r. Shaftwall System: Non-load-bearing fire-rated wall assemblies that provide critical, life safety, fire-resistant protection for elevator shafts, stairwells, vertical chases and mechanical enclosures.
- 1) Stud: ASTM C 645, of profile, size and base steel thickness required to produce assemblies complying with AISI Specification. Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated:
 - a) Depth: As indicated.
 - b) Minimum Base-Steel Thickness: As indicated.
 - 2) Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.
 - a) Minimum Base-Steel Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated.

3.SUSPENSION SYSTEMS

a.Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

b.Hanger Attachments to Concrete:

1)Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to [5] <Insert number> times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

a)Type: [Cast-in-place anchor, designed for attachment to concrete forms]
[Post installed, chemical anchor] [Post installed, expansion anchor].

2)Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to [10] <Insert number> times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

c.Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.064 mm) in diameter.

d.Flat Hangers: Steel sheet, [in size indicated on Drawings] .

e.Carrying Channels: Cold-formed, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum 1/2-inch- (13-mm-) wide flanges.

1)Depth: [As indicated on Drawings]

f.Furring Channels (Furring Members):

1)Cold-Formed Channels: 0.0538 inch (1.37 mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.

2)Steel Studs and Runners: ASTM C 645.

3)Non-Structural Studs: Cold-formed galvanized steel C-studs, as per ASTM C 645 for conditions indicated below:

a)Flange Size: 1 1/4 inch (32mm).

b)Web Depth: [As specified on drawings]

c)Member Description: ProSTUD 25 (25 EQ) 50 ksi.

1)Minimum Thickness: 0.0150 inches (0.3810 mm).

2)Design Thickness: 0.0158 inches (0.4013 mm).

d)Member Description: ProSTUD 20 (20 EQ) 65 ksi.

1)Minimum Thickness: 0.019 inches (0.4826 mm).

2)Design Thickness: 0.0200 inches (0.5080 mm).

e)Member Description: ProSTUD 30 mil (20 DW) 33ksi.

1)Minimum Thickness: 0.030 inches (0.760 mm).

2)Design Thickness: 0.0312 inches (0.792 mm).

f)Member Description: ProSTUD 33 mil (20 STR) 33ksi.

1)Minimum Thickness: 0.033 inches (0.8382 mm).

2)Design Thickness: 0.0346 inches (0.879 mm).

4)Non-Structural Track: Cold-Formed galvanized steel runner tracks in conformance with ASTM C 645 for conditions indicated below:

a)Flange Size: 1-1/4 inch (32 mm).

b)Web Depth: Track web to match stud web size.

c)Minimum Material Thickness: Track thickness to match wall stud thickness or as per design.

5)"EQ" (Equivalent Gauge Thickness) Steel Studs and Runners: Members that can show certified third party testing with gypsum board in accordance with ICC ES AC86 (Approved May 2012) need not meet the minimum thickness limitation or minimum section properties set forth in ASTM C 645. The submission of an evaluation report is acceptable to show conformance to this requirement.

6)Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.

a)Minimum Base-Metal Thickness: [As indicated on Drawings]

7)Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.

a)Configuration: Asymmetrical.

g)Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1)Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

a)Armstrong World Industries, Inc.; Drywall Grid Systems.

b)Chicago Metallic Corporation; Drywall Grid System.

c)USG Corporation; Drywall Suspension System.

4.AUXILIARY MATERIALS

a.General: Provide auxiliary materials that comply with referenced installation standards.

1)Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

b.Isolation Strip at Exterior Walls: Provide[**one of**] the following:

- 1)Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), non-perforated.
- 2)Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, **1/8 inch (3.2 mm)** thick, in width to suit steel stud size.

c.Drywall Penetration Barrier Mesh: Supply and install Barrier Mesh steel expanded metal panels as a penetration barrier behind gypsum wallboard walls and/or ceilings, where noted on the drawings.

- 1)Basis-of-Design Product: Subject to compliance with requirements provide Barrier Mesh supplied by ClarkDietrich Building Systems [**BM75-9F Maximum Security**] or a comparable product from one of the members of the SFA:
- 2)The finished shape of the mesh openings shall be a flattened diamond, per ASTM F 1267, Style 2.
- 3)Barrier Mesh Clips: Barrier Mesh shall be attached to framing members using Barrier Mesh Clips and the appropriate threaded fasteners.
 - a)For steel framing install a flat head bugle type self-tapping fine thread screw long enough to penetrate the framing member a minimum of 3/8 inch.
 - b)For wood framing applications install a 1-5/8 inch fine thread drywall screw allowing the fastener to penetrate the framing member at least 1½ inches.
 - c)In ceiling applications BM-Clips shall be spaced a minimum of (6 or 12) inches along ceiling joists.

PART 12EXECUTION

1.EXAMINATION

- a.Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- b.Proceed with installation only after unsatisfactory conditions have been corrected.

2.PREPARATION

- a.Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1)Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- b.Coordination with Sprayed Fire-Resistive Materials:
 - 1)Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset

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anchor plates are required, provide continuous plates fastened to building structure not more than **24 inches (610 mm)** o.c.

2)After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.INSTALLATION, GENERAL

a.Installation Standard: ASTM C 754.

1)Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.

2)Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.

3)Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.

4)Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

b.Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

c.Install bracing at terminations in assemblies.

d.Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

4.INSTALLING FRAMED ASSEMBLIES

a.Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1)Single-Layer Application: [**16 inches (406 mm)**] [**24 inches (610 mm)**] o.c. unless otherwise indicated.

2)Multilayer Application: [**16 inches (406 mm)**] [**24 inches (610 mm)**] o.c. unless otherwise indicated.

3)Tile Backing Panels: [**16 inches (406 mm)**] o.c. unless otherwise indicated.

b.Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

c.Install studs so flanges within framing system point in same direction.

d.Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1)Sip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

2)Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a)Install two studs at each jamb unless otherwise indicated.

b)Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.

c)Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3)Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4)Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

a)Install fire-resistant partitions using manufacturer's proprietary equivalent gauge studs in compliance with requirements of [UL V450] [UL V438] [UL U419].

b)Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5)Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

6)Curved Partitions:

a)Bend track to uniform curve and locate straight lengths so they are tangent to arcs.

b)Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (152 mm) o.c.

e.Direct Furring:

1)Screw to wood framing.

2)Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

f.Z-Furring Members:

1)Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.

2)Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

3)At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (305 mm) from corner and cut insulation to fit.

g.Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

5.INSTALLING SUSPENSION SYSTEMS

a.Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1)Hangers: [**48 inches (1219 mm)**] <Insert spacing> o.c.

2)Carrying Channels (Main Runners): [**48 inches (1219 mm)**] <Insert spacing> o.c.

3)Furring Channels (Furring Members): [**16 inches (406 mm)**] [**24 inches (610 mm)**] <Insert spacing> o.c.

b.Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

c.Suspend hangers from building structure as follows:

1)Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

a)Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2)Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

a)Size supplemental suspension members and hangers to support ceiling loads within [**performance limits established by referenced installation standards**] <Insert deflection limit>.

3)Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

4)Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.

5)Do not attach hangers to steel roof deck.

6)Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

7)Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

8)Do not connect or suspend steel framing from ducts, pipes, or conduit.

d.Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

e.Seismic Bracing: Sway-brace suspension systems [**with hangers used for support**] <Insert requirements>.

f.Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

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- g.Installation Tolerances: Install suspension systems that are level to within [**1/8 inch in 12 feet (3 mm in 3.6 m)**] <Insert dimensions> measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

6.INSTALLING DRYWALL PENETRATION BARRIER MESH

a.Install Drywall Penetration Barrier Mesh as follows:

- 1)Barrier Mesh sheets may be installed with diamond running in direction most suitable.
- 2)BM-Clips shall be installed to secure the mesh to the framing members.
- 3)Mesh joints occurring on framing members may either join staggered or butt together.
- 4)It is acceptable to overlap mesh joints to achieve tie-in.
- 5)BM sheets shall join, begin and terminate on a framing member.
- 6)BM sheets not joining on framing member shall be wire tied with 18GA steel tie wire. Wire tying shall be no less frequent than the installation of Mesh Clips.

END OF SECTION

09 31 00 – CERAMIC TILE**1 PART ONE – GENERAL****1.1 WORK SPECIFIED HEREIN**

All labor, materials, equipment and services necessary to furnish and install the ceramic tile and related items as indicated or specified.

1.2 SUBSTITUTIONS

In accordance with Section 01600.

1.3 QUALITY ASSURANCE

- A. Standards: materials, preparation and installation shall conform to ANSI Standards as listed and the detailed installation instruction of the material manufacturer insofar as applicable.
- B. Installation of Ceramic tile with Portland Cement Mortar: ANSI A-108.5
- C. Referenced Specifications, insofar as any portions are applicable, are hereby made a direct part of this Specification as though repeated herein.

1.4 PRODUCT DELIVERY

- A. Deliver tile to the job in unopened cartons sealed with a grade seal bearing name of manufacturer and the words “Standard Grade” printed thereon.
- B. Manufactured mortars and grouts shall contain hallmark certifying compliance with referenced standards and be types recommended by tile manufacturer for specific applications.
- C. Adhesives shall be in containers labeled with hallmark certifying compliance with referenced standards.
- D. Deliver dry-set mortar in sealed, moisture proof containers.
- E. Store materials under cover in manner to prevent damage or contamination.

1.5 JOB CONDITIONS

- A. Set and grout tile in Portland Cement mortar when surface temperature is at least 50° F. and rising.
- B. Comply with minimum temperature recommendations of manufacturer's for bonding and grouting materials in other than Portland Cement mortar.
- C. Protect adjoining work surfaces before tile work begins.

1.6 INSPECTION

- A. Inspect surfaces to receive tile before starting installation. Notify the Architect in writing of any defects or conditions that will prevent satisfactory tile installation. Starting of work will imply acceptance of surfaces to receive tile.
- B. Close areas which tile is being set to traffic and other work. Keep closed until tile is firmly set, minimum time of three days. Protect tile work from damage until acceptance.

1.7 SUBMITTALS

- A. Submit samples in accordance with Section 01340 for all work under this Section. Submit samples of all types of tile specified herein of the size stated.
- B. Furnish manufacturer's printed instructions for use of latex portland cement and mortar.
- C. Extra Stock: provide 6 cartons of each type of ceramic tile for Owner's future use.

2 PART TWO – PRODUCTS

- A. Comparison Product to Marmol Export USA; contact Adelpho Noriega at 714-448-5105 / email anorieha@marmolusa.com. The interior wall surface (for example) in the toilet room dome shall be 2X2 matte tile. The solid color of the product shall match as close as possible to Dunn Edwards colors and create the following theme...
 - 1. The ten feet high wall surface shall be divided into five equally spaced horizontal regions. The top region at the dome base shall be Silver Bullet DE6381. The region directly below to be Formal Gray DE6382.

The middle region shall be Bank Vault DE6384. Directly below shall be a region of Iron Fixture DE6384. The bottom region to be Black Bean DE6385.

2. All floor tiles to be 2X2 Matte DE6385 Black Bean.

2.1 MATERIALS

- A. Floor tiles shall be as scheduled on interior finish drawings. Provide all necessary shapes and trimmers of similar tile as required.
- B. Wall tile shall be as scheduled on interior finish drawings. Provide all necessary trim shapes of tile as required.
 1. Portland Cement: ASTM C-150, Type I
 2. Aggregate: ASTM C-144 for mortar and grout.
 3. Hydrate Lime: ASTM C-206, Type S.
- C. Water – Potable
- D. Reinforcing: 2" x 2' – 16/16 gauge welded wire mesh. 09310-2
- E. Membrane: 15 lb. Felt or 4 mil polyethylene film, furnish and install under this section.
- F. Glazed tile grout: Tile Mate 719, or equal; color as scheduled.
- G. Floor tile grout: Hydroment, with acrylic additive, color as scheduled.
- H. Latex Portland Cement Mortar: ANSI A-118.4.
- I. Expansion Joints (Includes control, contraction and isolation joints):
- J. Sealant: Two component complying with ASTM C-920, Type M, Class 25, grade NS for joint in vertical surfaces; Grade P, use T for joints in horizontal surfaces.
- K. Back-Up: Flexible compressible type of closed-cell foam polyethylene or butyl rubber, rounded at surface to contact sealant, as shown in TCA details, and as recommended by sealant manufacturer. It shall fit neatly into the joint with 1/8" compaction and to such a height to allow a sealant depth of 1/2 the width of the joint. Sealant shall not bond to the back-up material.

3 PART THREE – EXECUTION**3.1 INSTALLATION**

- A. Floors: Install floors using latex portland cement mortar in accordance with ANS A-108.1 and TCA methods F113-95.
- B. Grout tile with specified grout, slightly depressed.
- C. Slope floors uniformly to floor drains where required.
- D. Provide expansion joints, control joints, contraction joints, and isolation joints in accordance with TCA method EJ-711-95.
- E. Walls: Install wall tile in cement mortar in accordance with ANSI A-108.5 and TCA methods w-243-95 (metal studs) and W211-95 or W202-95 (masonry or concrete).
- F. Align all joints in wall tile vertically and horizontally.
- G. Grout all tile with specified grout.
- H. Provide expansion joints, control joints, contraction joints and isolation joints in accordance with TCA method EJ-711-84.
- I. Preparation: Tile edges to which the sealant will bond must be clean and dry. Sand or grind as necessary to obtain optimum sealant bond.
- J. Prime tile edges when recommended by the sealant manufacturer. Take care to keep primer off tile faces.
- K. Installation: set back-up when mortar is placed or utilize removable wood strip to provide space for back up after mortar has cured.
- L. Install sealant after tile work and grout are dry. Follow sealant manufacturer's recommendation.
- M. **CLEANING AND PROTECTION**

Clean tile after grouting and protect from other trades. Cure all ceramic tile floors for a minimum of 72 hours.

END OF SECTION

09 90 00 – PAINTING AND COATING

PART 1 GENERAL

1.1 REGULATORY REQUIREMENTS

- A. Conform to applicable building code for flame spread/fuel contribution/smoke development rating requirements for finishes.
- B. Comply with applicable city, county, state, and federal requirements and ordinances regarding maximum VOC (Volatile Organic Compound) content of coatings. Verification of compliance with this section shall be provided at the request of the enforcing agency. Documentation may include, but is not limited to, the following:
 - 1. Manufacturer's product specification.**
 - 2. Field verification of on-site product containers.**
- C. Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARM Architectural Suggested Control Measure as shown in Table 4.504.3 unless more stringent local limits apply. The VOC content limit for coatings that do not meet the definitions for the specialty coatings categories listed in Table 4.504.3, shall be determined by classifying the coating as a Flat, Nonflat, or Nonflat-High Gloss coating, based on its gloss, as defined in subsections 4.21, 4.36, and 4.37 of the California Air Resources Board, Suggested Control measure, and the corresponding Flat, Nonflat, or Nonflat-High Gloss VOC limit in Table 4.504.3 shall apply.
- D. All paints and coatings shall meet or exceed performance standards noted in SCAQMD Rule 1113, and shall be applied either by hand or high volume, low-pressure spray, or by using water-based or low volatile organic compound (VOC) coating, and coating transfer or spray equipment with high transfer efficiency.
- E. Aerosol Paints and Coatings shall meet the Product-Weighted MIR Limits for ROC in Section 94522(a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, in Sections 94522(c)(2) and (d)(2) of California Code of Regulations, Title 17, commencing with Section 94520: and in areas under the jurisdiction of the governing Air Quality Management District where additional compliance with the VOC percentage by weight of product limits per regulations.

1.2 SUMMARY:

A. Section Includes: Painting and finishing of all items and surfaces, unless otherwise indicated or listed under exclusions below:

1. Paint all exposed surfaces, except as otherwise indicated, whether or not colors are designated.
2. Include field painting of exposed exterior and interior plumbing, mechanical and electrical work, except as indicated below. All Double Check Detector Assemblies (DCDA) and risers shall be painted and maintained by the property owner with the following paint color specifications: Rust-Oleum Satin Interior/Exterior Acrylic Latex, "Hunt Club Green" no. 794452 (quart). This condition is subject to Fire Department inspection and approval when work is completed.
3. Paint exterior stucco where indicated on Drawings.
4. Add Water Based Anti-Graffiti Clear Coating at vulnerable exterior areas.

B. Work Included:

1. The intent and requirements of this section is that all work, items and surfaces which are normally painted and finished in a building of this type and quality, shall be so included in this contract, whether or not said work, item or surface is specifically called out and included in the schedules and notes on the drawings, or is, or is not, specifically mentioned in these specifications.

C. The following general categories of work and items that are included under other sections shall not be a part of this section:

1. Shop prime painting of structural and miscellaneous iron or steel.
2. Shop prime painting of hollow metal work.
3. Shop finished work and items.

The Room Finish Schedules indicated on the drawings indicate the location of surfaces to be painted or finished. The Schedule's indications are general and do not necessarily define the detail requirements. Include all detailed refinements and further instructions as may be given for the required complete finishing of all spaces and rooms.

1.3 SUBMITTALS:

A. Product Data: Submit complete manufacturer's descriptive literature with LEED® information highlighted and specifications in accordance with the provisions of Section 01 30 00.

1. Materials List: Submit complete lists of materials proposed for use, giving the manufacturer's name, catalog number, and catalog cut for each item when applicable. When required, provide a list of paint and

coating materials proposed for use, which equates such materials with the design-basis products specified.

2. Provide LEED® data on all paints and coatings used in the work.

B. Samples: In accordance with provisions of Section 01 30 00, submit, on 8-1/2 inch by 11 inch hardboard, samples of each color, gloss, texture, and material selected by the Architect from standard colors available for the coatings required.

1. For natural and stained finishes, provide sample on each type and quality of wood used on the project.

C. Manufacturer's Instructions: Submit the manufacturer's current recommended methods of installation, including relevant limitations, safety and environmental cautions, application rates, and composition analysis.

1.4 QUALITY ASSURANCE:

A. Regulatory Requirements: Comply with applicable codes and regulations of governmental agencies having jurisdiction, including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provisions. Regulatory changes may affect the formulation, availability, or use of specified coatings. Confirm availability of coatings to be used prior to job going out to bid and before start of painting project.

1. Comply with the current applicable regulations of the California Air Resources Board (CARB), the local AQMD, and the Environmental Protection Agency (EPA).

B. Field Sample: When and as directed by the Architect, apply one complete coating system for each color, gloss and texture required. When approved, the sample panel areas will be deemed incorporated into the Work and will serve as the standards by which the subsequent Work of this Section will be judged.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Storage and Protection: Use all means necessary to protect the materials of this Section before, during, and after installation.

B. Deliver materials to job site in new, original, and unopened containers bearing manufacturer's name and trade name. Store where directed in accordance with manufacturer's instructions.

1.6 PROJECT CONDITIONS:

A. Do not apply exterior materials during fog, rain or mist, or when inclement weather is expected within the dry time specified by the manufacturer. No exterior or interior painting shall be done until the surfaces are thoroughly dry and cured. Do not apply paint when temperature is below 50° F. Avoid painting surfaces when exposed to direct sunlight.

2.1 MANUFACTURERS:

A. Manufacturer's catalog names and number of paint types in this Section herein are based on products of Dunn-Edwards Corporation and are the standard of quality against which the Architect will judge equivalency. The quantity of titanium dioxide, the use of clays, aluminum silicate, talc and the purity of acrylic materials are a few of the criteria which will be used by the Architect in determining equivalency of materials.

2.2 MATERIALS:

A. Paints: Provide ready-mixed, except field-catalyzed coatings. Pigments must be fully ground, maintaining soft paste consistency, capable of being readily and uniformly dispersed into a complete homogeneous mixture. Paints must have good flowing and brushing properties and be capable of drying or curing free of streaks and sags.

B. Accessory Materials: Linseed oil, shellac, solvents, and other materials not specified but required to achieve required finishes must be of high quality and approved by manufacturer.

2.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- F. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.
- G. Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.
- H. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in well ventilated area, unless required otherwise by manufacturer's instructions.
- I. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply materials when surface and ambient temperatures are outside the ranges required by paint manufacturer.
- B. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
- C. Do not apply exterior coatings during rain or snow, or when relative humidity is above 75 percent, unless required otherwise by manufacturer's instructions.
- D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

- E. Minimum Application Temperature for Varnish and Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- F. Provide lighting level of 80 foot candles measured mid- height at substrate surface.

1.5 PRECAUTIONS

- A. Do not store paints, oils, thinners and other flammable items inside the building. Store in approved containers when not in actual use during painting. Keep fire hazard at a minimum.
- B. Take precaution to protect public and construction workers during progress of work.
- C. Furnish a temporary fire extinguisher of suitable chemicals and capacity, located near flammable materials.

PART 2 PRODUCTS

1. Scope

This Standard establishes environmental requirements for paints. The standard does not include stains, clear finishes, or paints sold in aerosol cans.

2. Definitions.

For the purpose of this Standard, the following definitions apply.

- 2.1 Paints: Liquid, liquefiable or mastic composition that is converted to a solid protective, decorative, or functional adherent film after application as a thin layer. These coatings are intended for on-site application to interior or exterior surfaces of residential, commercial, institutional, or industrial buildings¹.
- 2.2 Volatile Organic Compounds (VOCs): Compounds as defined by U. S. Environmental Protection Agency (EPA) in 40 CFR § 51.100 (s), (s) (1).
- 2.3 Aromatic Compounds: Hydrocarbon compounds containing one or more 6-carbon benzene rings in the molecular structure.

3. Product-Specific Performance Requirements.

3.1 Interior Topcoats. Products intended for interior opaque topcoat use shall meet the following requirements.

3.1.1 Scrubbability (Abrasion Resistance). The product shall demonstrate at least 100 cycles (200 separate strokes) before failure, as determined by American Society for Testing and Materials (ASTM) D2486-89, Standard Test Method for Scrub Resistance of Interior Latex Flat Wall Paints.

3.1.2 Hiding Power (Opacity). The product shall demonstrate a minimum 0.95 contrast ratio at 400 square feet per gallon as determined by ASTM D2805-88, Standard Test Method for Hiding Power of Paints by Reflectometry. Compliance will be determined by testing a white paint having a minimum 80% reflectance.

3.1.3 Washability (Stain Removal). The product shall demonstrate the following minimum requirements for stain removal as determined by ASTM 4828-91 Mechanical Method, Standard Test Method for Practical Washability of Organic Coatings.

Flat2	5 minimum rating
Non-Flat	7 minimum rating

3.2 Exterior Topcoats. Products intended for exterior opaque topcoat use shall meet the following requirements.

3.2.1 Hiding Power (Opacity). The product shall demonstrate a minimum 0.95 contrast ratio at 400 square feet per gallon as determined by ASTM D2805-88, Standard Test Method for Hiding Power of Paints by Reflectometry. Compliance will be determined by testing a white paint having a minimum 80% reflectance.

4. Product-Specific Environmental Requirements.

4.1 Chemical Component Limitations.

4.1.1 VOCs. The VOC concentrations of the product shall not exceed those listed below as determined by U. S. Environmental Protection Agency (EPA) Reference Test Method 24 (Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coatings), Code of Federal Regulations Title 40, Part 60, Appendix A.

The calculation of VOC shall exclude water and tinting color added at the point of sale.

Interior Coatings:

Coating	VOC weight in grams/liter of product
Non-Flat3	150
Flat	50

Exterior Coatings:

Coating	VOC weight in grams/liter of product
Non-Flat4	200
Flat	100

4.1.2 Aromatic Compounds. The product must contain no more than 1.0% by weight of the sum total of aromatic compounds. Testing for the concentration of these compounds will be performed if they are determined to be present in the product during a materials audit.

4.2 Chemical Component Restrictions. The manufacturer shall demonstrate that the following chemical compounds are not used as ingredients in the manufacture of the product.

- 4.2.1 Halomethanes
 - methylene chloride
- 4.2.2 Chlorinated ethanes
 - 1,1,1-trichloroethane
- 4.2.3 Aromatic solvents
 - benzene
 - toluene (methylbenzene)
 - ethylbenzene
- 4.2.4 Chlorinated ethylenes
 - vinyl chloride
- 4.2.5 Polynuclear aromatics
 - naphthalene
- 4.2.6 Chlorobenzenes
 - 1,2-dichlorobenzene
- 4.2.7 Phthalate esters
 - di (2-ethylhexyl) phthalate
 - butyl benzyl
 - phthalate di-n-
 - butyl phthalate
 - di-n-octyl
 - phthalate diethyl
 - phthalate
 - dimethyl
 - phthalate
- 4.2.8 Miscellaneous semi-volatile organics
 - isophorone
- 4.2.9 Metals and their compounds
 - antimon
 - y
 - cadmiu
 - m
 - hexavalent
 - chromium lead
 - mercury
- 4.2.10 Preservatives (antifouling agents)
 - formaldehyde
- 4.2.11 Ketones
 - methyl ethyl
 - ketone methyl
 - isobutyl ketone
- 4.2.12 Miscellaneous volatile organics
 - acrolein
 - acrylonitril
 - e

5. Packaging Requirements.

5.1 Toxics in Packaging.

- 5.1.1 The manufacturer shall demonstrate that paint cans and their components are not fabricated with lead.

Appendix: Labeling Requirements for Certification by Green Seal

Unless otherwise approved in writing by Green Seal, the following labeling requirements shall apply:

1. The Green Seal Certification Mark must appear on the packaging.
2. Whenever the certification mark appears on a package or product, the product or package must contain a description of the basis for the certification. The description shall be in a location, style, and typeface that are easily readable by the consumer. The description shall read as follows:
This product meets Green Seal environmental standards for volatile organic compounds (VOCs) and other ingredients.
3. The packaging shall be accompanied by a brief statement discouraging disposal into drains and encouraging consultation with local authorities for disposal requirements or recycling opportunities.
4. Paints which have been formulated without VOCs shall be designated Class A and may contain a special designation to that effect on the label.

Notes:

1. ASTM D16-91, Standard Terminology Relating to Paint, Varnish, Lacquer, and Related Products. Stains and clear finishes, which are included in the ASTM definition, are not covered by this standard.
2. If the manufacturer has not characterized the paint as to gloss, the specular gloss level at 60° will be determined. Flat paints are those which register less than 5 and non-flat paints are those which register a 5 or greater. The gloss reading will be determined by ASTM D523-89, Standard Test Method for Specular Gloss.

CAL Green

Low-Emitting Materials: Paints & Coatings

Intent

To reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

Requirements

Paints and coatings used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) must comply with the following criteria as applicable to the project scope:

- Architectural paints and coatings applied to interior walls and ceilings must not exceed the volatile organic compound (VOC) content limits established in Green Seal Standard GS-11, Paints, First Edition, May 20, 1993.
- Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limit of 250 g/L established in Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.
- Clear wood finishes, floor coatings, stains, primers, and shellacs applied to interior elements must not exceed the VOC content limits established in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.

Potential Technologies & Strategies

Specify low-VOC paints and coatings in construction documents. Ensure that VOC limits are clearly stated in each section of the specifications where paints and coatings are addressed. Track the VOC content of all interior paints and coatings during construction.

INTERIOR COATINGS

PRIMERS		
EFF-STOP® Select	Interior/Exterior Masonry Primer/Sealer (50 g/L)	ESSL00
CONCRETE BLOCK FILLER	Modified Copolymer Smooth Block Filler (50 g/L)	W 6329
ECOSHIELD® PRIMER	Low-Odor/Zero VOC Interior Latex Primer (<2 g/L)	W 600*
ENSO® PRIMER	Low-Odor/Zero VOC Interior Primer (<2 g/L)	ENSO00*
INTER-KOTE®	Interior Acrylic Enamel Undercoater (50 g/L)	W 6325
VINYLASTIC® Select	Interior Wall Sealer (20 g/L)	VNSL00
ULTRA-GRIP® Premium	Interior/Exterior Multi-Purpose Primer (55 g/L)	UGPR00
FLATS		
ACOUSTIKOTE®	Latex Flat Ceiling Paint (0 g/L)	W 615
AQUAFALL® FLAT	Latex Dry Fall Flat (30 g/L)	W 6079
ECOSHIELD® FLAT	Low-Odor/Zero VOC Interior Latex Flat Paint (<2 g/L)	W 601*

ENSO® FLAT	Low-Odor/Zero VOC Interior Flat Paint (<2 g/L)	ENSO10*
SPARTAWALL® FLAT	Interior Flat Paint (20 g/L)	SWLL10
SUPREMA® FLAT	Interior Flat Paint (40 g/L)	SPMA10
VERSAFLAT® FLAT	Interior/Exterior Latex Flat Paint (25 g/L)	W 6240
NON-FLATS		
AQUAFALL® EGGSHELL	Latex Dry Fall Eggshell (60 g/L)	W 6270
AQUAFALL® LOW SHEEN	Latex Dry Fall Low Sheen (50 g/L)	W 6078
ARISTOWALL™ SEMI-GLOSS	Interior Semi-Gloss Paint (50 g/L)	AWLL50
ARISTOWALL™ GLOSS	Interior Gloss Paint (50 g/L)	AWLL60
ECOSHIELD® LOW SHEEN	Low-Odor/Zero VOC Interior Latex Low Sheen Paint (<2 g/L)	W 602*
ECOSHIELD® SEMI-GLOSS	Low-Odor/Zero VOC Interior Acrylic Semi-Gloss Paint (<2 g/L)	W 603*
ENSO® EGGSHELL	Low-Odor/Zero VOC Interior Eggshell Paint (<2 g/L)	ENSO30*
ENSO® SEMI-GLOSS	Low-Odor/Zero VOC Interior Semi-Gloss Paint (<2 g/L)	ENSO50*

SPARTAWALL® VELVET	Interior Velvet Paint (50 g/L)	SWLL20
SPARTAWALL® EGGSHELL	Interior Eggshell Paint (50 g/L)	SWLL30
SPARTAWALL® LOW SHEEN	Interior Low Sheen Paint (50 g/L)	SWLL40
SPARTAWALL® SEMI-GLOSS	Interior Semi-Gloss Paint (50 g/L)	SWLL50
SPARTASHIELD® GLOSS	Interior/Exterior 100% Acrylic Gloss Paint (50 g/L)	SSHL60
SUPREMA® VELVET	Interior Velvet Paint (50 g/L)	SPMA20
SUPREMA® EGGSHELL	Interior Eggshell Paint (50 g/L)	SPMA30
SUPREMA® LOW SHEEN	Interior Low Sheen Paint (50 g/L)	SPMA40
SUPREMA® SEMI-GLOSS	Interior Semi-Gloss Paint (50 g/L)	SPMA50
VERSAWALL® VELVET	Interior/Exterior Latex Flat Enamel (50 g/L)	W 6230E
VERSATIN® LOW SHEEN	Interior/Exterior Latex Low Sheen Paint (50 g/L)	W 6250E
VERSAGLO® SEMI-GLOSS	Interior/Exterior Latex Semi-Gloss Paint (50 g/L)	W 6160E
VERSAGLOSS® GLOSS	Interior/Exterior Latex Gloss Paint (50 g/L)	W 6220E

* Paints and coatings may be classified as “Zero VOC” if they contain none of the VOC solvents that are added to conventional latex paints. Trace amounts of VOC may be present as residual components of other ingredients. Some compounds detected as VOC under laboratory test methods using high heat may not be volatile under normal ambient conditions.

2.1 MATERIALS

- A. Coatings: Ready mixed. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating with good flow and brushing properties; capable of drying or curing free of streaks or sags.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

- C. Patching Materials: Latex filler.

2.2 FINISHES

- A. Refer to schedule at end of Section.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report to Owner's Representative any condition that may potentially affect proper application.
- C. Test shop applied primers for compatibility with subsequent cover materials.

3.2 PREPARATION

- A. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or finishing.
- B. Correct minor defects and clean surfaces which affect work of this Section. Remove existing coatings which exhibit loose surface defects.
- C. Shellac and seal marks which may bleed through surface finishes.
- D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- E. Gypsum Board Surfaces: Latex fill minor defects. Spot prime defects after repair.
- F. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- G. Uncoated Steel and Iron Surfaces: Remove grease, scale, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
- H. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

- I. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- J. Interior Wood Items Schedule to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.
- K. Shop Finished Items: Finish in accordance with AWI standards and guide lines.
- L. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.3 SURFACE PREPARATION OF PREVIOUSLY COATED SURFACES

A. General:

- 1. Remove cracked and deteriorated sealants and caulking.**
- 2. Remove chalk deposits and loose, blistered, peeling, scaling, or crazed finish to bare base material or sound substrate by scraping and sanding.**
- 3. Wash surfaces with solution of TSP to remove wax, oil, grease, and other foreign material; rinse, and allow to dry. Exercise caution that TSP solution does not soften existing coating.**
- 4. Abrade glossy surfaces by sanding or wiping with liquid deglosser.**
- 5. Remove mildew as specified above.**
- 6. Test compatibility of existing coatings by applying new coating to small, inconspicuous area. If new coatings lift or blister existing coatings, request recommendation from Owner's Representative.**
- 7. Apply specified primer to surfaces scheduled to receive coatings.**

B. Metal:

- 1. Remove rust from surfaces to bare metal in accordance with SP3 "Power Tool Cleaning".**
- 2. Exercise care not to remove galvanizing.**
- 3. Complete preparation as specified for new work.**

3.4 PROTECTION

- A. Protect elements surrounding the work of this Section from damage or disfiguration.
- B. Repair damage to other surfaces caused by work of this Section.
- C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.
- D. Remove empty paint containers from site.

3.5 APPLICATION

- A. The intent of these Specifications is to produce the highest quality appearance of paint and finish surfaces. Employ skilled mechanics only. The proper preparation of all surfaces will be strictly enforced and wherever finished surfaces show any defects due to improper preparation, workmanship, etc., the defects shall be removed and the work refinished at the expense of the Contractor.
- B. Apply products in accordance with manufacturer's instructions. Final finish coats shall have visual evidence of solid hiding and uniform appearance, and shall be free and smooth of brush marks, streaks, sags, runs, laps, or skipped areas.
- C. Low-Emitting Materials: VOC emissions from paints and coatings must not exceed the VOC and chemical component limits of Green Seal's GS-11 Standard and LEED® requirements.
- D. Clear Wood Finishes, floor coatings, stains, shellacs, and sealers applied to interior elements will not exceed the VOC content limits established in California's South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.
- E. Mix, prepare, and store painting and finishing materials in accordance with manufacturer's directions.
- F. Do not apply finishes to surfaces that are not dry.
- G. Examine surfaces to be painted before beginning painting work. Work of other trades that has been left or installed in a condition not suitable to receive paint, stain, and other specified finish must be repaired or corrected by the applicable trade before painting. Painting of defective or unsuitable surface implies acceptance of the surfaces.
- H. Beware of a condition known as critical lighting. This condition causes shadows that accentuate even the slightest surface variations. A pigmented sealer will provide tooth for succeeding decorative coating, but does not equalize smoothness or surface texture. Any corrective action to drywall must be done by the drywall contractor prior to decorating.
- I. Apply each coat to uniform finish and thickness.

- J. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- K. Sand lightly between coats on wood and metal items to achieve required finish.
- L. Allow applied coat to dry before next coat is applied.
- M. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- N. Prime back surfaces of interior and exterior woodwork scheduled to be painted with primer paint.
- O. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.
- P. Edges of paint adjoining other materials or colors shall be sharp and clean with no overlapping.

3.6 PROTECTION:

A. Protect previously installed Work and materials, which may be affected by Work of this Section.

1. Protect prefinished surfaces, lawns, shrubbery and adjacent surfaces against paint and damage.
2. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or splatter from fouling surfaces not being painted.
3. Protect surfaces, equipment, and fixtures from damage resulting from use of fixed, movable and hanging scaffolding, planking, and staging.

B. Provide WET PAINT signs, barricades, and other devices required to protect newly finished surfaces. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

3.7 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Paint shop primed equipment. Paint shop prefinished items where exposed to view in finished spaces.
- B. Paint exposed air handlers, roof ventilators, goose necks, exhaust fans and other items on the roof with 2 coats exterior enamel. Prepare surfaces in accordance with the base metal or primer as specified herein.

3.8 PREPARATION:

- A. Perform preparation and cleaning procedures in strict accordance with coating manufacturer's instructions for each substrate condition.
- B. Concrete and masonry surfaces must be dry, clean, and free of dirt, efflorescence, encrustation, and other foreign matter. Glazed surfaces on concrete must be roughened or etched to uniform texture.
- C. Ferrous metal shall be cleaned of oil, grease, and foreign matter with solvent. Prime within 3 hours after preparation.
- D. Sand and scrape metal to remove loose primer and rust.
- E. Solvent clean galvanized metal and then treat with an etching-type solution if recommended by the finish manufacturer. Prime cleaned and treated galvanized metal the same day that cleaning has been performed.
- F. Remove dust, grit and foreign matter from wood surfaces. Sand surfaces and dust clean. Spot coat knots, pitch streaks, and sappy section with pigmented stain sealer when surfaces are to be painted. Fill nail holes, cracks, and other defects after priming and spot prime repairs when fully cured.
- G. Remove hardware and accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not-to-be-finish painted, or provide surface-applied protection. Reinstall removed items upon completion of Work in each area.
- H. Existing surfaces to be recoated must be thoroughly cleaned and de-glossed by sanding or other means prior to painting. Spot prime patched and bare areas with same primer as specified for new work.
- I. Thoroughly back paint all surfaces of exterior and interior finish lumber and millwork, including doors and window frames, trim, and cabinetwork that will be concealed after installation. Back paint items to be painted or enameled with the priming coat. Use a clear sealer for back priming where transparent finish is required.
- J. Bare and covered pipes, ducts, hangers, exposed steel and ironwork, and primed metal surfaces of equipment installed under mechanical and electrical work must be cleaned prior to priming.
- K. Preparation of other surfaces shall be performed following specific recommendations of the coatings manufacturer.
- L. Bond breakers and curing agents must be removed and the surface cleaned before primers, sealers or finish paints can be applied.
- M. All drywall surfaces must be completely dry and dust free before painting. Skim coated drywall must be sealed with an alkyd based sealer or a waterborne sealer recommended by the paint manufacturer for this surface. Use the appropriate light or medium tack masking tape.

.04 APPLICATION:

A. Apply painting and finishing materials in accordance with the manufacturer's submittals, as approved. Use applicators and techniques best suited for the material and surfaces to which applied.

1. Specified are the minimum number of coats that are to be applied. Apply additional coats when undercoats, stains or other conditions show through final paint coat, until paint film is of uniform finish, color and appearance.
2. Tint slightly all undercoats to approximate the color of the finish coat.

B. Apply each material at not less than the manufacturer's recommended spreading rate:

1. **Provide a total dry film thickness of not less than 1.2 mils per coat**
2. **Apply prime coat to material, which is required to be painted or finished.**
3. **Finish exterior doors on tops, bottoms, and edges same as exterior faces, after fitting.**
4. **Sand lightly and dust clean between succeeding coats.**

3.8 CLEANING AND TOUCH-UP

- A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.
- B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.
- C. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.
- D. Spot painting will be allowed to correct soiled or damaged paint surfaces only when touch-up spot will blend into surrounding finish and is invisible to normal viewing as determined by the Owner's Representative. Otherwise, re-coat entire section to corners or visible stopping point.

3.9 COLOR SCHEDULE

- A. Refer to Room Finish Schedule and Exterior Paint Schedule on Drawings.
- B. Colors will be selected from color chip samples provided by manufacturer of paint system approved for use. Match approved samples for color, texture and coverage.

3.10 FINISH SCHEDULE

- A. Apply the following finishes to the surfaces specified and/or as on the finish schedule on the drawings. Apply all materials in accordance with manufacturer's

instructions on properly prepared surfaces and foundation coats. All intermediate undercoats must be tinted to approximate the final color.

1. Architect will confirm a color schedule prior to start of painting to designate the various colors and locations required for the work.

INTERIOR SYSTEMS

Gypsum Board					
Acrylic Copolymer or Acrylic Copolymer/Acrylic or Acrylic Copolymer/100% Acrylic Systems					
FINISH	RESIN TYPE	COAT	FINISH SCHEDULE	MPI	
	Acrylic Copolymer	1	PREP-SEAL (W 6324) Interior Latex Wall Sealer		
Flat	Acrylic Copolymer		SPARTAWALL (SWLL10) Interior Flat Paint		53
Velvet			SPARTAWALL (SWLL20) Interior Velvet Paint		44
Eggshell	Acrylic	2 & 3	SPARTAWALL (SWLL30) Interior Eggshell Paint		52
Low Sheen			SPARTAWALL (SWLL40) Interior Low Sheen Paint		43
Semi-Gloss			SPARTAWALL (SWLL50) Interior Semi-Gloss Paint		54
Gloss	100% Acrylic		SPARTASHIELD (SSHL60) Interior/Exterior 100% Acrylic Gloss Paint		114

Gypsum Board					
Zero VOC					
Modified Copolymer or Modified Copolymer/100% Acrylic Systems					
FINISH	RESIN TYPE	COAT	FINISH SCHEDULE	MPI	NOTES
	Modified Copolymer	1	ECOSHIELD (W 600) Low-Odor/Zero VOC Interior Latex Primer	149	
Flat	Modified Copolymer	2 & 3	ECOSHIELD (W 601) Low-Odor/Zero VOC Interior Latex Flat Paint	143	
Low Sheen			ECOSHIELD (W 602) Low-Odor/Zero VOC Interior Latex Low Sheen Paint		
Semi-Gloss	100% Acrylic		ECOSHIELD (W 603) Low-Odor/Zero VOC Interior Acrylic Semi-Gloss Paint	147	

Masonry Plaster					
Premium Zero VOC					
100% Acrylic System					
FINISH	RESIN TYPE	COAT	FINISH SCHEDULE	MPI	NOTES
	100% Acrylic	1	ENSO (ENSO00) Low-Odor/Zero VOC Interior Primer	149	
Flat	100% Acrylic	2 & 3	ENSO (ENSO10) Low-Odor/Zero VOC Interior Flat Paint	143	
Eggshell			ENSO (ENSO30) Low-Odor/Zero VOC Interior Eggshell Paint	145	
Semi-Gloss			ENSO (ENSO50) Low-Odor/Zero VOC Interior Semi-Gloss Paint	147	

Concrete Block (CMU) without Block Filler

Zero VOC

Modified Copolymer or Modified Copolymer/100% Acrylic Systems

FINISH	RESIN TYPE	COAT	FINISH SCHEDULE	MPI
	Modified Copolymer	1	ECOSHIELD (W 600) Low-Odor/Zero VOC Interior Latex Primer	149
Flat	Modified Copolymer	2 & 3	ECOSHIELD (W 601) Low-Odor/Zero VOC Interior Latex Flat Paint	143
Low Sheen			ECOSHIELD (W 602) Low-Odor/Zero VOC Interior Latex Low Sheen Paint	
Semi-Gloss	100% Acrylic		ECOSHIELD (W 603) Low-Odor/Zero VOC Interior Acrylic Semi-Gloss Paint	147
<i>Notes</i>				

Concrete Block (CMU) without Block Filler

Premium Zero VOC

100% Acrylic System

FINISH	RESIN TYPE	COAT	FINISH SCHEDULE	MPI	NOTES
	100% Acrylic	1	ENSO (ENSO00) Low-Odor/Zero VOC Interior Primer	149	
Flat	100% Acrylic	2 & 3	ENSO (ENSO10) Low-Odor/Zero VOC Interior Flat Paint	143	
Eggshell			ENSO (ENSO30) Low-Odor/Zero VOC Interior Eggshell Paint	145	
Semi-Gloss			ENSO (ENSO50) Low-Odor/Zero VOC Interior Semi-Gloss Paint	147	

Concrete Block (CMU) with Block Filler

Zero VOC Finish Coat

Modified Copolymer or Modified Copolymer/100% Acrylic Systems

FINISH	RESIN TYPE	COAT	FINISH SCHEDULE	MPI	NOTES
	Modified	1	Concrete Block Filler Smooth (W 6329)		
Flat	Modified Copolymer	2 & 3	ECOSHIELD (W 601) Low-Odor/Zero VOC Interior Latex Flat Paint	143	
Low Sheen			ECOSHIELD (W 602) Low-Odor/Zero VOC Interior Latex Low Sheen Paint		
Semi-Gloss	100% Acrylic		ECOSHIELD (W 603) Low-Odor/Zero VOC Interior Acrylic Semi-Gloss Paint	147	

Concrete Block (CMU) with Block Filler

Premium Zero VOC Finish Coat

Modified Copolymer/100% Acrylic System

FINISH	RESIN TYPE	COAT	FINISH SCHEDULE	MPI	NOTES
	Modified Copolymer	1	Concrete Block Filler Smooth (W 6329)		
Flat	100% Acrylic	2 & 3	ENSO (ENSO10) Low-Odor/Zero VOC Interior Flat Paint	143	
Eggshell			ENSO (ENSO30) Low-Odor/Zero VOC Interior Eggshell Paint	145	
Semi-Gloss			ENSO (ENSO50) Low-Odor/Zero VOC Interior Semi-Gloss Paint	147	

Wood

Acrylic/Acrylic Copolymer or Acrylic or Acrylic/100% Acrylic Systems

FINISH	RESIN TYPE	COAT	FINISH SCHEDULE	MPI
	Acrylic	1	ULTRA-GRIP Premium (UGPR00) Interior/Exterior Multi-Purpose Primer	17
Flat	Acrylic Copolymer	2 & 3	SPARTAWALL (SWLL10) Interior Flat Paint	53
Velvet			SPARTAWALL (SWLL20) Interior Velvet Paint	44
Eggshell	SPARTAWALL (SWLL30) Interior Eggshell Paint		52	
Low	Acrylic		SPARTAWALL (SWLL40) Interior Low Sheen Paint	43
Semi-Gloss			SPARTAWALL (SWLL50) Interior Semi-Gloss Paint	54
	100% Acrylic		SPARTASHIELD (SSHL60) Interior/Exterior 100% Acrylic Gloss Paint	114

Notes:

Wood

Zero VOC

Modified Copolymer or Modified Copolymer/100% Acrylic Systems

FINISH	RESIN TYPE	COAT	FINISH SCHEDULE	MPI	NOTES
	Modified	1	ECOSHIELD (W 600) Low-Odor/Zero VOC Interior Latex	149	
Flat	Modified Copolymer	2 & 3	ECOSHIELD (W 601) Low-Odor/Zero VOC Interior Latex	143	
Low			ECOSHIELD (W 602) Low-Odor/Zero VOC Interior Latex Low		
Semi-Gloss	100% Acrylic		ECOSHIELD (W 603) Low-Odor/Zero VOC Interior Acrylic Semi-Gloss	147	

Wood					
<i>Premium Zero VOC</i>					
100% Acrylic System					
FINISH	RESIN TYPE	COAT	FINISH SCHEDULE	MPI	NOTES
	100% Acrylic	1	ENSO (ENSO00) Low-Odor/Zero VOC Interior Primer	149	
Flat	100% Acrylic	2 & 3	ENSO (ENSO10) Low-Odor/Zero VOC Interior Flat Paint	143	
Eggshell			ENSO (ENSO30) Low-Odor/Zero VOC Interior Eggshell	145	
Semi-			ENSO (ENSO50) Low-Odor/Zero VOC Interior Semi-Gloss	147	

Metal Ferrous					
<i>Acrylic/Acrylic Copolymer or Acrylic or Acrylic/100% Acrylic Systems</i>					
FINISH	RESIN TYPE	COAT	FINISH SCHEDULE	MPI	NOTES
	Acrylic	1	ULTRA-GRIP Premium (UGPR00) Interior/Exterior Multi-Purpose Primer	17	
Flat	Acrylic Copolymer	2 & 3	SPARTAWALL (SWLL10) Interior Flat Paint	53	
Velvet			SPARTAWALL (SWLL20) Interior Velvet Paint	44	
Eggshell			SPARTAWALL (SWLL30) Interior Eggshell Paint	52	
Low	Acrylic	2 & 3	SPARTAWALL (SWLL40) Interior Low Sheen Paint	43	
Semi-			SPARTAWALL (SWLL50) Interior Semi-Gloss Paint	54	
Gloss	100% Acrylic		SPARTASHIELD (SSHL60) Interior/Exterior 100% Acrylic Gloss Paint	114	

Notes:

Metal Ferrous					
<i>Zero VOC</i>					
<i>Acrylic Urethane/Modified Copolymer or Acrylic Urethane/100% Acrylic Systems</i>					
FINISH	RESIN TYPE	COAT	FINISH SCHEDULE	MPI	NOTES
	Acrylic Urethane	1	Rustoleum Sierra Metalmax S37		Distributed by D-E
Flat	Modified Copolymer	2 & 3	ECOSHIELD (W 601) Low-Odor/Zero VOC Interior Latex	14	
Low			ECOSHIELD (W 602) Low-Odor/Zero VOC Interior Latex Low		
Semi-	100% Acrylic		ECOSHIELD (W 603) Low-Odor/Zero VOC Interior Acrylic Semi-	14	

Metal Ferrous					
<i>Premium Zero VOC</i>					
<i>Acrylic Urethane/100% Acrylic System</i>					
FINISH	RESIN TYPE	COAT	FINISH SCHEDULE	MPI	NOTES
	Acrylic Urethane	1	Rustoleum Sierra Metalmax S37		Distributed by D-E
Flat	100% Acrylic	2 & 3	ENSO (ENSO10) Low-Odor/Zero VOC Interior Flat Paint	143	
Eggshell			ENSO (ENSO30) Low-Odor/Zero VOC Interior Eggshell	145	
Semi-			ENSO (ENSO50) Low-Odor/Zero VOC Interior Semi-Gloss	147	

Metal Non-Ferrous				
Acrylic/Acrylic Copolymer or Acrylic or Acrylic/100% Acrylic Systems				
FINISH	RESIN TYPE	COAT	FINISH SCHEDULE	MPI
	Acryli	1	ULTRA-GRIP Premium (UGPR00) Interior/Exterior Multi-Purpose Primer	134
Flat	Acrylic Copolymer	2 & 3	SPARTAWALL (SWLL10) Interior Flat Paint	53
Velvet			SPARTAWALL (SWLL20) Interior Velvet Paint	44
Eggshell	SPARTAWALL (SWLL30) Interior Eggshell Paint		52	
Low	Acryli		SPARTAWALL (SWLL40) Interior Low Sheen Paint	43
Semi-	c		SPARTAWALL (SWLL50) Interior Semi-Gloss Paint	54
Gloss	100% Acrylic		SPARTASHIELD (SSHL60) Interior/Exterior 100% Acrylic Gloss Paint	114
<i>New galvanized metal should be pre-treated with Supreme Chemical Metal Clean & Etch (ME01)</i>				

Metal Non-Ferrous					
Premium Zero VOC					
Acrylic Urethane/100% Acrylic System					
FINISH	RESIN TYPE	COAT	FINISH SCHEDULE	MPI	NOTES
	Acrylic Urethane	1	Rustoleum Sierra Metalmax S37		Distributed by D-E
Flat	100% Acrylic	2 & 3	ENSO (ENSO10) Low-Odor/Zero VOC Interior Flat Paint	143	
Eggshell			ENSO (ENSO30) Low-Odor/Zero VOC Interior Eggshell	145	
Semi-			ENSO (ENSO50) Low-Odor/Zero VOC Interior Semi-Gloss	147	

END OF SECTION

10 14 50 – SITE SIGNS

PART 1 GENERAL

Signs may be required by local authority. Verify if additional access route signage or replacement signs will be required. Install in accordance with acceptable industry standards and in accordance with this specification section.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements herein, provide products from one of the following:

1. **Best Manufacturing Company, Montrose, Colorado.**
2. **Mohawk Sign Systems, Schenectady, New York.**
3. **Nelson-Harkins, Chicago, Illinois.**
4. **ASI Signs, Dallas, Texas.**

2.2 HANDICAPPED PARKING

A. Screen Printed Signs:

1. **18 gage bonderized steel with blue baked enamel finish and white screen printed copy.**
2. **Copy and Size:**
 - a. "Handicapped Parking Only" - 12 inches by 18 inches.
 - b. "Van Accessible" - 12 inches by 6 inches.
3. **Acceptable Product: Best Traffic Signs No. SS04 with SS52 as required.**

B. Post: Galvanized pipe column minimum 9 feet long.

2.3 DIRECTIONAL SIGNS

A. Screen Printed Signs:

1. **Extruded aluminum panels with anodic finish and white screen printed copy.**
2. **Size and Configuration: As indicated on Drawings.**
3. **Copy: As indicated on Drawings.**
4. **Acceptable Product: Best Post and Plank as detailed on Drawings.**

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install signs plumb, level and square and in proper planes with other work, at heights as indicated by Owner's Representative.
- B. Anchor each plastic laminate sign with adhesive.
- C. Install signs with sufficient amount of foam tape for proper installation.
- D. Attach as recommended by sign manufacturer.
- E. Anchor each sign with adhesive.
- F. Coordinate arrival and installation of graphic signs with hardware installation. Graphic signs function as and are coordinated with the hardware as shown on the Drawings.

3.2 EXTERIOR INSTALLATION - PARKING AND DIRECTIONAL SIGNS

- A. Mount posts in 12 inch round by 2'-6" deep concrete footing.
- B. Handicapped Signs: 60 inches to bottom of lowest line (including "Van Accessible").

END OF SECTION

10 16 00 – URINAL SCREENS

1 PART ONE – GENERAL**1.1 WORK SPECIFIED HEREIN**

All labor, materials, equipment and services necessary to furnish and install toilet compartments and urinal screens as indicated or specified.

1.2 SUBMITTALS

- A. Submit shop drawings in accordance with Section 01340 for all work under this Section. Manufacturer's certificate of compliance shall accompany shop drawings attesting that the steel to be used conformed to Specification requirements. Shop drawings shall indicate plans, elevations, details of construction, sizes of openings and parts, anchoring devices, level in details finish, color, hardware fittings and fastenings.
- B. Submit samples in accordance with Section 01340. Submit 6" x 6" samples of each required metal finish and color. Samples to be on the same metal which will be used in the compartment assemblies.

1.3 QUALITY ASSURANCE

- A. Acceptable manufacturer's of units specified herein are: Accurate, General Partition, Knickerbocker and Metpar.
- B. Take field measurements prior to preparation of Shop Drawing and fabrication to assure proper fitting.
- C. Provide setting drawings, templates, instructions and directions for installation of anchorage devices.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

Deliver items in manufacturer's original unopened protective packaging. Store materials in original packaging to prevent soiling, physical damage or wetting. Handle so as to prevent damage to finished surfaces.

PART TWO – PRODUCTS

1.5 MATERIALS

- A. Doors and partition panels shall be 1" thick, sound insulated. Panel plates shall consist of 2 sheets of galvanized/bonderized steel not less than 22 gauge for doors, or 20 gauge for partitions, and shall have formed edges

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sealed with a continuous oval crown locking strip. Door edges shall be electrically welded with welds spaced not over 18" apart around the entire perimeter. Locking strips on doors and partitions, shall be mitered, welded and finished at the corners.

- B. Pilasters shall be 1 ¼" thick made of 2 sheets of 18 gauge galvanized/bonderized steel welded and finished as specified above. Bottom of pilasters shall be a jack-leveling screw to carry the weight of the compartment and to provide a secure mechanical anchorage to floor with adjustable floor fittings. Pilaster connection to the floor shall be concealed with a one piece 3" polished type 302 stainless steel shoe.
- C. Pilasters when set in place shall be securely braced with continuous 1" x 1 ½" lock seam tubular steel overhead bracing attached through the top of the pilaster with metal screws applied through the pilaster into the headrail on the inside of the stall. Headrail shall extend full length of installation and over end compartments and be fastened into wall brackets. Exposed ends of headrail to be capped. Headrail to be of "anti-grip" type.
- D. Pilasters shall be 1 ¼" thick made of 2 sheets of 16 gauge galvanized/bonderized steel welded and finished as specified for doors and partitions. Secure pilasters to overhead members with 7/16" diameter galvanized bolts. Secure pilaster connection using an integral 12 gauge split U channel welded to the pilaster member. Secure this connection using an external – internal locking saddle activated by 7/16" nuts and facing washers. Connection assembly to be hot-dipped galvanized. Provide and install pilaster key spacers between bottom of supporting members and finished ceiling line. Strains of lateral thrust to be transmitted to structural carrying member, independent of finished ceiling material. Provide a 3" stainless steel top trim piece, finished to match hardware.
- E. Dividing partitions and pilasters shall be attached to one another and to the walls with stirrup brackets. Trim shall be theft-proof one-way screws or bolts, held in place with concealed anchor clips without the use of exposed fasteners.
- F. Hardware and fittings:

1. Top hinge pin shall be secured at 3 points with all door hinge fittings fully flush with face plates of the door.
 2. Each door shall be equipped with chrome plated cast alloy coat hook and bumper, concealed latch with bolt of stainless steel permitting exterior access, a one-piece chrome plated stop and 10160-2 keeper and concealed controlled power bearing gravity hinge.
 3. The door shall be adjustable to permit rest position at any angle with a 270° arc and the weight at all times shall be carried by a thrust bearing with all moving parts concealed within the door thickness.
 4. Pilasters hinge brackets shall be factory mounted flush to the pilaster and of zamac alloy.
- G. Hardware: provide manufacturer's standard design heavy duty operating hardware and accessories, in stainless steel No. 4 bright polish finish.
- H. Reinforcing: Internally reinforce compartment panels where shown for attachment of grab bars.
- I. Cutouts: provide reinforced cutouts in compartment panels where specified toilet accessories are installed through compartment panels.
- J. Urinal screens shall be 1" thick made of 2 sheets of 20 gauge galvanized/bonderized steel constructed as specified above for partitions. Additionally, both vertical edges are to be supplied with additional reinforcement consisting of a wood core of 4" wide.
- K. Provide stirrup brackets, 2 for each screen, made of heat treated, polished and anodized extruded aluminum alloy. Each stirrup bracket shall be 3" long and provided with 4 holes for attachment of screws to the wall and 2 thru-bolts through the screen.
- L. Finish of all toilet compartments and urinal screens to be baked-on enamel on galvanized/bonderized steel, nominal thickness 1 ½ mils. Finish colors shall be as selected from manufacturer's standard color chart allowing for selection of 2 colors.

3 PART THREE – EXECUTION

3.1 INSTALLATION

Install toilet compartments and urinal screens in strict accordance with manufacturer's instructions, of size, and at locations indicated. Erect in a rigid, substantial manner straight and plumb, and with all horizontal lines level. Clearance at the wall shall be approximately 1" for panels and 1" for pilasters; not

□City of Rancho Mirage City Project No. CP15-315 Rancho Mirage Observatory□
more than 1/2" between pilasters and panels. All evidence of drilling, cutting and fitting to room finish shall be concealed in the finish work. Clearance at vertical edges of doors shall be uniform from top to bottom and shall not exceed 3/16". Adjust hardware and leave in perfect working order. Adjust door hinges to hold door open at approximately 30°.

*****END OF SECTION*****

10 44 16.13 – PORTABLE FIRE EXTINGUISHERS

PART 1 GENERAL

1.1 QUALITY ASSURANCE

1.2 Certifications

- 1. Conform to NFPA-10 requirements for extinguishers.**
- 2. Provide units conforming with ANSI/UL 711 and ANSI/UL 92.**

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements indicated, provide products of one of the following:

- 1. JL Industries.**
- 2. Larsens Manufacturing Co.**

- B. Substitutions: Submit under provisions of Section 01600.

2.2 FIRE EXTINGUISHERS

- A. Multi-purpose dry chemical type U.L. 299, (ammonium phosphate), with pressure gauge

- 1. Capacity: 10.0 lbs.**
- 2. U.L. Rating: 4A:60B:C**
- 3. Acceptable Product: MP10 by Larsens.**

- B. Mounting bracket: Manufacturer's standard.

2.3 FINISHES

- A. Extinguisher: Red enamel.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install using skilled workmen in accordance with manufacturer's printed instructions.

END OF SECTION

10 80 00 – TOILET ACCESSORIES

1 PART ONE – GENERAL**1.1 WORK SPECIFIED HEREIN**

All labor, materials, equipment and services necessary to furnish and install all toilet accessories as indicated or specified.

1.2 SUBSTITUTIONS

In accordance with Section 01 60 00.

1.3 SUBMITTALS

Submit shop drawings in accordance with Section 01340 for all Work under this Section.

1.4 QUALITY ASSURANCE

This Specification is based on products as manufactured by Bobrick Dispensers, Inc., Los Angeles, California, unless otherwise noted. Products equaling or exceeding this Specification as manufactured by D.J. Alexander Corporation or American Dispenser Company are acceptable for bidding.

1.5 GENERAL REQUIREMENTS

- A. Review drawings for locations of toilet accessories and verify dimensional requirements for recessed units. Coordinate location of blocking and built-in anchorage devices.
- B. Notify Architect of any conflicts with accessory locations and partition dimensions or piping interference.
- C. Use concealed fastening wherever possible.
- D. Provide anchors, bolts and other necessary fasteners, and attach accessories securely to walls and partitions in locations as shown or directed.
- E. Provide products of the same manufacturer for each type of accessory unit and for units exposed in the same areas, wherever possible.

- F. Stamped names or labels on exposed faces of units will not be permitted, except where otherwise specified.

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2 PART TWO – PRODUCTS

2.1 ACCESSORIES

(Refer to schedule on drawings)

3 PART THREE – EXECUTION

3.1 INSTALLATION

- A. Install all toilet accessories at locations indicated in strict accordance with manufacturer's printed instructions.
- B. Install concealed mounting devices and fasteners fabricated of the same material as the accessories or of galvanized steel.
- C. Install exposed mounting devices and fasteners finished to match the accessories.
- D. Provide theft-resistant fasteners for all accessory mountings.
- E. Secure toilet room accessories to adjacent walls and partitions in accordance with the manufacturer's instructions for each item and each type of substrate construction.
- F. Install grab bars in accordance with manufacturer's printed instructions at locations indicated. Install connectors or support angles between studs. Attachment of support angles to studs must be sufficient to withstand a horizontal pull of 300 pounds. Accurately position connector assemblies and tighten to the support angles before wall finish is applied. After wall surface is finished, secure concealed mounting plate to connector assembly using stainless steel machine screws furnished by the manufacturer, where grab bars install on toilet compartments make through-bolted connection with specified anchors.

*****END OF SECTION*****

21 13 10– FIRE SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Provide a fire suppression sprinkler system throughout the PROJECT in accordance with all local laws and regulations, NFPA 13, and authorities having jurisdiction.
- B. Submit product data for valves, sprinklers, specialties, and alarms, for wet sprinkler systems.
- C. Design and Installation Approval: Acceptable to authorities having jurisdiction.
- D. Hydraulically design sprinkler systems according to NFPA 13.
 - 1. Perform, or cause to be performed, a fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system hydraulic design calculations. Existing tests may be accepted if less than one year old.
 - 2. Sprinkler systems shall utilize separate underground water mains to supply the fire sprinkler system and domestic water supply.
 - 3. Submit sprinkler system drawings identified as "working plans" and calculations according to NFPA 13. Submit required number of sets to authorities having jurisdiction for review, comment, and approval. Include system hydraulic calculations. "Working plans and hydraulic calculations shall be signed and sealed by a Professional Engineer registered in the State of the project.
- E. Comply with NFPA 13 and NFPA 70.
 - 1. Minimum sprinkler system design requirements for new multi-occupancy retail centers shall be as required for ordinary hazard (group 2).
- F. UL-listed and -labeled and FMG-approved pipe and fittings.
- G. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and local building code.
- H. Submit test reports and certificates as described in NFPA 13.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795.
- B. Cast-Iron Threaded Flanges: ASME B16.1, Class 250, raised ground face, bolt holes spot faced.
- C. Cast-Iron Threaded Fittings: ASME B16.4, Class 250, standard pattern.
- D. Grooved-End Fittings: UL-listed and FMG-approved, ASTM A 536, Grade 65-45-12 ductile iron or ASTM A 47 Grade 32510 malleable iron, with grooves or shoulders designed to accept grooved couplings.
- E. Grooved-End Couplings: UL 213, ASTM A 536 ductile-iron or ASTM A 47 malleable-iron housing, with enamel finish. Include gaskets, bolts, and accessories.
- F. Provide hangers, supports, and seismic restraints with UL listing and FMG approval for fire- protection systems.

2.2 VALVES

- A. Fire-Protection Service Valves: UL listed and FMG approved, with 175-psig nonshock minimum working-pressure rating. Valves for use with grooved piping may be grooved type. Indicating valves shall be butterfly or ball type, bronze body with threaded ends, and integral indicating device with 115-V ac, electric, 2-circuit supervisory switch indicator.
- B. Gate Valves: UL 262, cast bronze, threaded ends, solid wedge, outside screw and yoke, rising stem.
- C. Swing Check Valves, NPS 2 and Smaller: UL 312 or MSS SP-80, Class 150; bronze body with bronze disc and threaded ends.
- D. Swing Check Valves, NPS 2-1/2 and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring and flanged ends.
- E. Alarm Check Valves: UL 193, 175-psig working pressure, designed for horizontal or vertical installation, with cast-iron flanged inlet and outlet, bronze grooved seat with O-ring seals, and single-hinge pin and latch design. Include trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, retarding chamber, fill-line attachment with strainer, and drip cup assembly.

F. Ball Drip Valves: UL 1726, automatic drain valve, NPS 3/4, ball check device with threaded ends.

G. Provide backflow preventers in accordance with requirements of local plumbing code, health code, and Water Company:

1. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application and for vertical mounting, Include outside screw and yoke gate valves on inlet and outlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.

a. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

2. Double-Check Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application; and for vertical mounting. Include shutoff valves on inlet and outlet; test cocks; and two positive-seating check valves.

a. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

3. Reduced-Pressure Detector Assembly Backflow Preventers: ASSE 1047, FM approved or UL listed, and suitable for continuous pressure application; and for vertical mounting. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves; and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer.

a. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

4. Double-Check Detector Assembly Backflow Preventers: ASSE 1048, FM approved or UL listed, and suitable for continuous pressure application; and for vertical mounting. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; two positive-seating check valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer.

a. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

2.3 SPRINKLERS

A. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.

- B. Sprinkler types include the following:
 - 1. Upright, pendent, Concealed.
 - 2. Pendent dry-type sprinklers.
- C. Sprinkler Finishes: White painted, Chrome-plated and bronze.
- D. Sprinkler Escutcheons: Chrome-plated steel, one piece, semi-recessed; with finish to match sprinklers.

2.4 PIPING SPECIALTIES AND ALARM DEVICES

- A. Fire Department Connection: UL 405, flush, wall-type, with cast-brass body; NH-standard thread inlets or Storz connection matching local fire department threads.
 - 1. Finish: Polished brass.
- B. Water-Motor-Operated Alarms: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch- diameter, cast- aluminum alarm gong with red- enamel factory finish. Include NPS 3/4 inlet and NPS 1 drain connections.
- C. Water-Flow Indicators: UL 346; electrical-supervision, vane-type water-flow detector; with 250- psig pressure rating; and designed for horizontal or vertical installation. Include 2 single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
- D. Pressure Switches: UL 753; electrical-supervision-type, water-flow switch with retard feature.
Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.
- E. Valve Supervisory Switches: UL 753; electrical; double-pole, double throw; with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
- F. Pressure Gages: UL 393, 3-1/2- to 4-1/2-inch- diameter dial with dial

range of 0 to 250 psig. PART 3 - EXECUTION

3.1 PIPE AND FITTING APPLICATION

- A. Use steel pipe with threaded, roll-grooved, or cut-grooved joints.

1. For steel pipe joined by threaded fittings, use Schedule 40.
 2. For steel pipe joined by welding or roll-grooved pipe and fittings, use Schedule 10.
- B. Pipe between Fire Department Connections and Check Valves: Use galvanized steel pipe with flanged or threaded joints.
- C. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water service piping.
- D. Install all equipment in accordance with manufacturer's instructions.

3.2 PIPING INSTALLATION

- A. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve.
- B. Install sprinkler zone control valves, test assemblies, and drain headers adjacent to standpipes. C. Install ball drip valves to drain piping between fire department connections and check valves.
Drain to floor drain or outside building.
- D. Install alarm devices in piping systems and connect to fire alarm system.
- E. Protect piping from earthquake damage as required by NFPA 13.
- F. Install pressure gages on riser or feed main, and at each sprinkler test connection. Install gages to permit removal, and install where they will not be subject to freezing.
- G. Install fire-protection service valves supervised-open, located to control sources of water supply except from fire department connections. Where there is more than one control valve, provide permanently marked identification signs indicating portion of system controlled by each valve.
- H. Install backflow preventers in potable-water supply sources in accordance with local water companies' regulations.
- I. Install alarm check valves for proper direction of flow, including bypass check valve and retard chamber drain line connection.

3.3 SPRINKLER APPLICATIONS

- A. Rooms without Ceilings: Upright sprinklers.
- B. Rooms with Suspended Ceilings: Recessed pendent sprinklers with adjustable escutcheon.
- C. Wall Mounting: Sidewall sprinklers with escutcheon.
- D. Sprinklers Subject to Freezing: Pendent dry-type, and sidewall dry-type sprinklers with escutcheon.
- E. Sprinkler and Escutcheon Finishes: Chrome plated in finished spaces exposed to view, rough bronze in unfinished spaces not exposed to view.

3.4 TESTING

- A. Flush, test, and inspect sprinkler piping systems according to NFPA 13, Chapter "System Acceptance."

END OF SECTION

22 05 29 – Hangers & Supports**PART 1 GENERAL****1.1 REGULATORY REQUIREMENTS****A. Section Includes:**

1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Sleeves.
6. Mechanical sleeve seals.
7. Formed steel channel.
8. Firestopping relating to plumbing work.
9. Firestopping accessories.
10. Equipment bases and supports.
11. Metal framing system.
12. Fastener systems.
13. Pipe stand fabrication.
14. Pipe positioning systems.

B. Conform to applicable code for support of plumbing.**C. General: Comply with Appropriate Standards.**

1. American Society of Mechanical Engineers: ASME
2. American Society of Testing and Materials: ASTM
3. American Welding Society: AWS
4. Factory Mutual Approval Guide, A Guide to Equipment, Materials & Services Approved
By Factory Mutual Research For Property Conservation: FM
5. Manufacturers Standardization Society of the Valve and Fittings Industry: MSS
6. Underwriters Laboratories Inc.: UL

1.2 SUBMITTALS**A. Submit Data on all materials.****B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and details of trapeze hangers.****C. Product Data:**

1. Submit manufacturers catalog data including load capacities.
2. Submit Manufacturers preparation and installation instructions.
3. Submit Manufacturers Certificate to verify all products meet or exceed specified requirements.

D. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.4 CAL Green ENVIRONMENTAL REQUIREMENTS

- A. Review environmental conditions affecting products on site prior to installation.
- B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.
- C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.
- D. Provide ventilation in areas subject to corrosive ambient air conditions.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Piping:
 1. **Conform to ASTM F 708.**
- B. Manufacturers:
 1. **B-Line.**
 2. **Tolco.**
 3. **PHD Manufacturing, Inc.**
- C. Plumbing Piping – Drainage, Waste, Vent and Storm:
 1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
 2. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 4. Wall Support: Welded steel bracket and wrought steel clamp.
 5. Vertical Support: Steel riser clamp.
 6. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

7. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

- D. Plumbing Piping - Water:
- E. Flexible Flashing: 47 mil thick sheet; compatible with roofing.
- F. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sealant: Listed and approved type.

2.6 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
 - 1. **Thunderline Link-Seal, Inc.**
 - 2. **NMP Corporation Model.**
- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

- A. Manufacturers:
 - 1. **B-Line.**
 - 2. **Tolco.**
 - 3. **Unistrut.**

2.8 FIRESTOPPING

- A. Manufacturers:
 - 1. **Dow Corning.**

2. **Hilti.**

3. **3M.**

- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

2.9 FIRESTOPPING ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Type as required.
- C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- D. General:
1. Furnish UL listed products or products tested by independent testing laboratory.
 2. Select products with rating not less than rating of wall or floor being penetrated.
- E. Non-Rated Surfaces:
1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
 2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

2.10 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
1. **B-Line.**
 2. **Tolco.**
 3. **Unistrut.**
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.11 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Manufacturers:
 - a. **B-Line.**
 - b. **Hilti.**
 - c. **Powers Fasteners.**
 2. Expansion Anchors:
 - a. Smooth wall, non-self-drilling internal plug expansion type anchors constructed of AISC 12L14 steel and zinc plated in accordance with Fed. Spec. QQ-A-325 type 1, Class 3.
 - b. Do not exceed 1/4 of average values for a specific anchor size using 2000 PSIG concrete only, for maximum working loads.
 - c. Locate spacing and install anchors in accordance with the manufacturer's recommendations.
 - d. Expansion anchors shall be U.L. listed.

2.12 PIPE STAND FABRICATION

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
1. Manufacturers:
 - a. **ERICO/Michigan Hanger Co.**
 - b. **MIRO Industries.**
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
1. Manufacturers:
 - a. **MIRO Industries.**
- D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members,

□City of Rancho Mirage City Project No. CP15-315 Rancho Mirage Observatory□
and pipe support, for roof installation without membrane penetration.

1. Manufacturers:

- a. **ERICO/Michigan Hanger Co.**
- b. **MIRO Industries.**
- c. **Portable Pipe Hangers.**

2. Base: Stainless steel.

3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous- thread rods.

4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless- steel, roller-type pipe support.

E. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.13 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:

- 1. **C & S Mfg. Corp.**
- 2. **HOLDRITE Corp.; Hubbard Enterprises.**
- 3. **Samco Stamping, Inc.**

2.14 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

B. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter

affecting bond of firestopping material.

- B. Remove incompatible materials affecting bond.
- C. Install backing damming materials to arrest liquid material leakage.
- D. Obtain permission from LAWA before drilling or cutting structural members.

3.3 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off- center closure for hanger installation before pipe erection.
 - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 - 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.

10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system

Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system

Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - a. Inserts shall be steel, slotted type and factory-painted.
 - 1) Single rod shall be equal to Anvil International Fig. 281.
 - 2) Multi-rod shall be with end caps and closure strips.
 - 3) Clip form nails flush with inserts.
 - 4) Maximum loading including pipe, contents and covering shall not exceed 75%
of rated insert
capability.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

- a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
 16. Supports from Steel Decks:
 - a. Support piping from steel deck with metal deck ceiling bolt.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer

of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

- a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
 - M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
 - N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
 - O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported.
Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.
- F. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- N. Insulated Piping: Comply with the following:
1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

- a. Option: Thermal-hanger shield inserts may be used. Include steel weight- distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight- distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping

insulation. O. Suspended Horizontal Piping:

1. Support piping independently from structure using heavy iron-hinged type hangers.
2. Provide electroplated solid-band hangers for 2-inch and smaller pipe.
3. Provide trapeze hangers of angles, angles bolted back-to-back, or channels to parallel lines of piping.
4. Provide wall brackets for wall-supported piping, and furnish pipe saddles for floor- mounted piping.
5. Provide supports with recommended lining for glass piping.
6. Provide supports with copper lining for uninsulated copper piping.
7. Suspend piping from inserts, using beam clamps with retaining clamp or locknut, steel fish plates, cantilever brackets or other accepted means.
8. Suspend piping by rods with double nuts.
9. Provide additional steel framing as required and accepted where overhead construction does not permit fastening hanger rods in required locations.
10. Support branch fixture water piping in chases with copper-plated metal brackets, secured to studs.

3.5 EQUIPMENT SUPPORTS

- A. Mount on or support from accepted foundations and supports, all noted equipment and related piping.
- B. Size, locate, and install noise and vibration isolation equipment in accordance with manufacturer's recommendations and after review.
- C. Select noise and vibration isolation equipment for lowest operating speed of equipment to be isolated.
- D. Ensure that lateral motion under equipment at start-up, shut-down or when unbalanced is no more than a maximum of 1/4 inch.
- E. Provide corrosion resistant mounting systems when exposed to the elements and other corrosive environments. Provide hot dip galvanized metal parts of mountings (except springs and hardware). Provide cadmium-plated and neoprene-coated springs and cadmium-plated nuts and bolts.
- F. Correct noise and vibration problems due to faulty equipment or poor workmanship, as directed, without additional charge to LAWA.
- G. Steel Spring
 - Type:
 1. Utilize bare stable springs without restraints.
 2. Provide spring with diameter not less than 80% of loaded operating height of spring.
 3. Design ends of spring so that they remain parallel during and after springs are loaded to their minimum specified deflections.
 4. Provide springs with 50% travel from operating deflection before reaching solid height.
 5. Provide spring mounts with 1/4 inch thick waffled neoprene acoustical pad bonded to underside of base plate.
- H. Provide resiliently mounted equipment bases raised to operating height with a minimum of 2 inch of clearance at bottom of base prior to installing equipment.
 1. Temporarily support bases on 2-inch thick (minimum) spacer blocks.
 2. Adjust mountings to transfer load from spacer blocks to mountings; remove spacer blocks after equipment installation, but immediately prior to operation.
- I. Concrete inertia blocks with adequate reinforcing steel will be provided under
General
Construction Work.
- J. Neoprene-In-Shear Isolation Rails: Furnish for horizontal pumps, air compressors, and vacuum pumps when supplied with fractional horsepower motors.

1. Provide top structural iron channel rails with tapped holes to accept machinery foundation bolts supported by properly loaded and located double deflection neoprene-in- shear mountings, equal to Type DNR - M.I.I.
 2. Provide mountings with 3/8 inch minimum static deflection and bolt holes for anchoring onto foundation equal to Type DNR - M.I.I.
- K. Neoprene-In-Shear Supported Concrete Inertia Bases: Provide for horizontal pumps, jockey pumps, air compressors, and vacuum pumps when supplied with one horsepower to three horsepower motors.
- L. Provide a minimum 6-inch thick concrete inertia block supported by double deflection neoprene-in-shear mountings, equal to Type ND - M.I.I., with form as noted for foundations. Bolt and grout equipment to concrete base. Provide minimum static deflection of 1 inch.
- M. Spring-Supported, Factory-Fabricated Inertia Bases: Provide for horizontal pumps (except fire pumps), bottom-supported vertical booster pumps, jockey pumps, rotary air compressors and vacuum pumps with five horsepower and larger motors.
1. Provide concrete inertia block with factory-fabricated steel structural perimeter frame, set on roofing paper, with equipment anchor bolt templates and mounting brackets supplied by vibration control manufacturer.
 2. Provide and locate under brackets, spring supports with a minimum static deflection of 1 inch and with leveling device to raise entire isolation base 2 inch above foundation.
 3. Provide minimum thickness required for concrete inertia bases as follows:
 - a. Motor Size 5 hp to 15 hp: 6 inch.
 - b. Motor Size 20 hp to 50 hp: 8 inch.
 - c. Motor Size 60 hp to 100 hp: 10 inch.
 - d. Motor Size Over 100 hp: 12 inch.
- N. Spring supported factory fabricated structural steel bases: Provide for vertical booster pumps suspended from floor slab above and through penetration.
1. Provide equipment rigidly bolted to spring supported reinforced structural base and isolated from suitable framed structural supports erected from floor slab.
 2. Provide reinforced structural steel base constructed with structural members having depth of section not less than 1/12 span between spring mountings and supplied by vibration control manufacturer.
 3. Provide a framed base to permit removal of any pump mounted on structural base.
 4. Provide structural supports erected from floor slab, sized and framed to accept spring mountings and supported loads.
 5. Piping in projected area of isolated structural pump base may be rigidly

supported from isolated pump base.

6. Provide spring mountings designed so that they are capable of supporting equipment at fixed elevation during installation, and adjusted to provide operating clearance in mountings of 1/4 inch.

O. Center of gravity (C.G.) mounted spring inertia blocks:

1. Equipment and its driving motor shall be integrally mounted on spring-supported concrete inertia blocks.
2. Provide inertia blocks sized to provide sufficient mass so that dynamic movement of equipment block assembly will be less than 1/16 inch peak-to-peak at any connection flange. Form shall be as noted for foundations.
3. Provide blocks and spring mountings arranged to accomplish dynamically symmetrical system with respect to total C.G. of spring assembly in all three major axes.
4. Provide steel spring mountings consisting of bare stable springs arranged in pendulum configuration with built-in adjustable side snubbers, leveling device and 1/4 inch thick neoprene acoustical base pad.
5. Provide mountings with a minimum static deflection corresponding to isolation efficiency of 90% at lowest equipment operating speed.

3.6 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.7 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

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- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.2 SUPPORTS

- A. Support horizontal and vertical piping against movement.

END OF SECTION

22 07 19 – PIPING INSULATION**PART 1 GENERAL – REQUIREMENTS****1.1 Confirm to Applicable codes.****PART 2 PRODUCTS****2.1 INSULATION**

- A. Insulation: ASTM C 547 [and ASTM C 795]; rigid molded, noncombustible.
 - 1. **'K' ('Ksi') value: ASTM C 177, 0.24 at 75 degrees F.**
 - 2. **Maximum Service Temperature: 850 degrees F.**
 - 3. **Maximum Moisture Absorption: 0.2 percent by volume.**

- B. Acceptable Manufacturers:
 - 1. **Manville.**
 - 2. **Owens-Corning.**

- C. Vapor Barrier Lap Adhesive:
 - 1. **Compatible with insulation.**

- D. Insulating Cement/Mastic:
 - 1. **ASTM C 195; hydraulic setting on mineral wool.**

- E. Fibrous Glass Fabric:
 - 1. **Cloth: Untreated; 9 oz/sq yd weight.**
 - 2. **Blanket: 1.0 lb/cu ft density.**
 - 3. **Weave: 5x5.**
 - 4. **Thickness: 1”**

- F. Indoor Vapor Barrier:
 - 1. **FRK self-sealing jacket.**
 - 2. **Vinyl emulsion type acrylic, compatible with insulation.**

- G. Flexible Foam Insulation

1. 1/2 inch thick flexible foam plastic insulation.**PART 3 EXECUTION****3.1 INSTALLATION**

- A. Install in accordance with NAIMA National Insulation Standards.
- B. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
- C. Insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive.**
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.**
- D. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- E. Insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.**
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.**
- F. Inserts and Shields:
 - 1. Application: Piping 1-1/2 inches diameter or larger.**

- 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.**
- 3. Insert location: Between support shield and piping and under the finish jacket.**
- 4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.**

G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

3.2 SCHEDULES

A. Plumbing Systems:

- 1. Thickness per this section**

END OF SECTION

22 10 00 – PLUMBING PIPING (GENERAL)**PART 1 GENERAL****1.1 QUALITY ASSURANCE**

- A. Perform Work in accordance with authority having jurisdiction standards. Utilize products as indicated in drawings and as allowed by authorities having jurisdiction.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Conform to ASME SEC IX and applicable state labor regulations.
- D. Welders Certification: In accordance with ASME SEC IX.
- E. Identify pipe with marking including size, ASTM material classification, ASTM specification, and water pressure rating.

1.2 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with authority having jurisdiction plumbing code.
- B. Conform to applicable code for installation of backflow prevention devices.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

PART 2 PRODUCTS**2.1 BALL VALVES**

- A. Up To and Including 3 Inches:
 - 1. Acceptable Products:**
 - a. Crane Model 9200 Series.
 - b. Stockham Model 5206 Series.
- B. 2 Inches and Larger:
 - 1. Acceptable Products:**
 - a. Crane Model 9200 Series.
 - b. Stockham Model 5206 Series.

2.2 GLOBE VALVES

- A. Up To and Including 3 Inches:
 - 1. **Acceptable Products:**
 - a. Milwaukee Model 572.
 - b. Crane Model 1702.
 - c. Stockham Model B-16.

- B. 2 Inches and Larger:
 - 1. **Acceptable Products:**
 - a. Milwaukee Model 572.
 - b. Crane Model 1702.
 - c. Stockham Model B-16.

2.3 WATER PRESSURE REDUCING VALVES

- A. Up to 2 Inches:
 - 1. **Acceptable Products: Watts Model 223.**

- B. Over 2 Inches:
 - 1. **Acceptable Products: Watts Model 127W.**

2.4 RELIEF VALVES

- A. Pressure Relief:
 - 1. **Acceptable Products: Watts Model 40.**

- B. Temperature and Pressure Relief:
 - 1. **Acceptable Products: Watts Model 40.**

2.5 STRAINERS

- A. Size 2 inch and Under:
 - 1. **Acceptable Products: Watts Model 77S.**

- B. Size 1-1/2 inch to (4 inch):
 - 1. **Acceptable Products: Watts Model 77F.**

2.6 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A 74 service weight, hub and spigot.
 - 1. **Fittings: Cast iron.**
 - 2. **Joints: Caulked joints, lead and oakum.**

- B. Cast Iron Pipe: ASTM A 888, no hub.
 - 1. **Fittings: Cast iron.**
 - 2. **Joints: ASTM C 564, neoprene gasket.**

- C. PVC Pipe: ASTM D 3034 SDR 35 or ASTM D 2665, SCH where allowed by code.
 - 1. **Fittings: PVC.**
 - 2. **Joints: ASTM F 477, elastomeric gaskets.**

2.7 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A 74 service weight.
 - 1. **Fittings: Cast iron.**
 - 2. **Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C 564 neoprene gaskets or lead and oakum.**

- B. PVC Pipe: ASTM D 2665 or ASTM D 3034 where allowed by code.
 - 1. **Fittings: PVC.**
 - 2. **Joints: ASTM D 2855, solvent weld with ASTM D 2564 solvent cement.**

2.8 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A 74, service weight.
 - 1. **Fittings: Cast iron.**
 - 2. **Joints: ASTM C 564, lead and oakum.**

- B. Cast Iron Pipe: ASTM A 888, no hub.
 - 1. **Fittings: Cast iron.**
 - 2. **Joints: ASTM C 564, neoprene gasket.**

- C. PVC Pipe: ASTM D 2665, Schedule 40, DWV.
 - 1. **Fittings: PVC.**
 - 2. **Joints: ASTM D 2855, solvent weld with ASTM D 2654, solvent cement.**

2.9 WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

- A. Ductile Iron Pipe: AWWA C151.
 - 1. **Fittings: AWWA C110, ductile or gray iron, standard thickness.**

2. **Joints: AWWA C111, rubber gasket with 3/4 inch diameter rods.**

B. CPVC Pipe: ASTM D 2846, Schedule 80.

1. **Fittings: CPVC ASTM F493, Schedule 80.**
2. **Joints: ASTM F 493, solvent weld, or ASTM D 2840.**

2.10 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Tubing: ASTM B 42, annealed.

1. **Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.**
2. **Joints: AWS A5.8, BCuP silver braze, lead free.**

B. CPVC: ASTM D 2846, Schedule 80.

1. **Fittings: CPVC, ASTM F 493.**
2. **Joints: ASTM F 493 or ASTM D 2846, solvent weld.**

2.11 WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B 88, Type L, hard drawn.

1. **Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.**
2. **Joints: ASTM B 32, solder, lead free, Grade 95TA.**

B. CPVC: ASTM D 2846, Schedule 80.

1. **Fittings: CPVC, ASTM F 493.**
2. **Joints: ASTM F 493 or ASTM D 2846, solvent weld.**

2.12 STORM WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A 74 service weight.

1. **Fittings: Cast iron.**
2. **Joints: ASTM C 564, neoprene gasket system or lead and oakum.**

B. Concrete Pipe: ASTM C 76.

1. **Fittings: Concrete.**
2. **Joints: ASTM C 443 (ASTM C 443M), rubber gaskets.**

C. PVC Pipe: ASTM D 2665 or ASTM D 3034 where allowed by code.

1. **Fittings: PVC.**
2. **Joints: ASTM D 2855, solvent weld with ASTM D 2564 solvent cement.**

2.13 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A 74 service weight.
1. **Fittings: Cast iron.**
 2. **Joints: ASTM C 564, neoprene gasket system or lead and oakum.**
- B. PVC Pipe: ASTM D 2665 or ASTM D 3034 where allowed by code.
1. **Fittings: PVC.**
 2. **Joints: ASTM D 2855, solvent weld with ASTM D 2564 solvent cement.**

2.14 STORM WATER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A 74 service weight.
1. **Fittings: Cast iron.**
 2. **Joints: ASTM C 564, neoprene gasket system or lead and oakum.**
- B. PVC Pipe: ASTM D 2665 or ASTM D 3034 where allowed by code.
1. **Fittings: PVC.**
 2. **Joints: ASTM D 2855, solvent weld with ASTM D 2564 solvent cement.**

2.15 NATURAL GAS PIPING, BURIED BEYOND 5 FEET OF BUILDING

- A. Polyethylene Pipe: ASTM 1248-65T
1. **Fittings: ASTM D 2683 or ASTM D 1248 socket type.**
 2. **Joints: Fusion welded.**

2.16 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Steel Pipe: ASTM A 53 Schedule 40 black.
1. **Fittings: ASTM A 234/A 234M, forged steel welding type.**
 2. **Joints: ASME B31.2, welded.**
 3. **Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 0.25 mm polyethylene tape.**

2.17 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A 53 Schedule 40 black.
 - 1. **Fittings: ASME B16.3, malleable iron, or ASTM A 234/A 234M, forged steel welding type.**
 - 2. **Joints: NFPA 54, threaded or welded to ANSI B31.1.**

- B. Copper Tubing: ASTM B 88, Type L, hard drawn.
 - 1. **Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.**
 - 2. **Joints: ASTM B 32, solder, lead free, Grade 95TA.**

2.18 FLANGES, UNIONS, AND COUPLINGS

- A. Pipe Size 3 Inches and Under:
 - 1. **Ferrous pipe: Class 150 malleable iron threaded unions.**
 - 2. **Copper tube and pipe: Class 150 bronze unions with soldered joints.**

- B. Pipe Size Over 1 Inch:
 - 1. **Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.**
 - 2. **Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.**

- C. Grooved and Shouldered Pipe End Couplings:
 - 1. **Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.**
 - 2. **Sealing gasket: "C" shape composition sealing gasket.**

- D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.19 GLOBE VALVES

- A. Up To and Including 3 Inches:
 - 1. **MSS SP-80, Class 125, bronze body, bronze trim, handwheel, bronze disc, solder ends.**

B. 2 Inches and Larger:

1. **MSS SP-85, Class 125, iron body, bronze trim, handwheel, outside screw and yoke, renewable bronze plug-type disc, renewable seat, flanged ends.**

2.20 BALL VALVES

- A. Construction, 4 Inches and Smaller: MSS SP-110, bronze, two piece body, chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder ends.

2.21 PLUG VALVES

- A. Construction 2-1/2 Inches and Larger: MSS SP-78, cast iron body and plug, pressure lubricated, Teflon or Buna N packing, flanged ends. Provide lever operator with set screw.

2.22 WATER PRESSURE REDUCING VALVES

A. Up to 2 Inches:

1. **MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, [threaded] [and] [double union] ends.**

B. Over 2 Inches:

1. **MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.**

2.23 RELIEF VALVES

A. Pressure Relief:

1. **AGA Z21.22 certified, bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated.**

B. Temperature and Pressure Relief:

1. **AGA Z21.22 certified, bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME SEC IV certified and labeled.**

- A. Size 2 inch and Under:
 - 1. **Class 150, threaded bronze body 300 psi CWP, Y pattern with 0.8 mm (1/32 inch) stainless steel perforated screen.**

- B. Size 1-1/2 inch to 4 inch:
 - 1. **Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.**

PART 3 EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

- H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors.
- I. Establish elevations of buried piping outside the building to ensure installed depth is below maximum frost depth.
- J. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
- K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- L. Provide support for utility meters in accordance with requirements of utility companies.
- M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
- N. Install bell and spigot pipe with bell end upstream.
- O. Install valves with stems upright or horizontal, not inverted.
- P. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.
- Q. Install water piping to ASME B31.9.
- R. Sleeve pipes passing through partitions, walls and floors.
- S. Inserts: Provide inserts for placement in concrete formwork.

3.3 APPLICATION

- A. Use grooved mechanical couplings and fasteners only in accessible locations.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

- D. Install globe valves for throttling, bypass, or manual flow control services.
- E. Provide plug valves in natural gas systems for shut-off service.

3.4 ERECTION TOLERANCES

- A. Establish invert elevations, slopes for drainage to per 1/4 inch per foot (2 percent) minimum. Maintain gradients.
- B. Slope water piping minimum 0.25 percent and arrange to drain at low points.

3.5 SERVICE CONNECTIONS

- A. Provide new sanitary and storm sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with approved backflow preventer and water meter with by-pass valves.
 - 1. **Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.**
- C. Provide new gas service complete with gas meter and regulators.

END OF SECTION

22 11 16 – DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- A. Performance Requirements: Unless otherwise indicated, minimum pressure requirements for water piping are as follows:
 - 1. Service Entrance Piping: 125 psig.
 - 2. Domestic Water Piping: 100 psig.
- B. Comply with NSF 14, "Plastic Piping Components and Materials."
- C. Comply with NSF 61, "Drinking Water System Components -

Health Effects." PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. Soft Copper Tubing: ASTM B 88, Types K , water tube, annealed temper with copper pressure fittings, cast-copper-alloy or wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
- B. Hard Copper Tubing: ASTM B 88, Types L , water tube, drawn temper with wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 1. Copper Unions: Cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to- metal seating surfaces and solder-joint or threaded ends.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Install listed pipe materials and joining methods below in the following applications:
 - 1. Aboveground Distribution Piping: Type L hard copper tubing.
 - 2. Belowground Service Piping: Type K soft copper tubing, with no joints.

3.2 VALVE APPLICATIONS

- A. Install gate valves close to main on each branch and riser serving two or more plumbing fixtures or equipment connections and where indicated.
- B. Install gate or ball valves on inlet to each plumbing equipment item, on each supply to each plumbing fixture not having stops on supplies, and elsewhere as indicated.
- C. Install drain valve at low points of horizontal runs, and where required to drain water distribution piping system.
- D. Install swing check valve on discharge side of each pump and elsewhere as indicated.
- E. Install ball valves in each hot-water circulating loop and discharge side of each pump.

3.3 PIPING INSTALLATIONS

- A. Install hangers and supports at intervals indicated in the applicable plumbing code and as recommended by pipe manufacturer.
- B. Support vertical piping at each floor.

3.4 INSPECTING AND CLEANING

- A. Inspect and test piping systems following procedures of authorities having jurisdiction.
- B. Clean and disinfect water distribution piping following procedures of authorities having jurisdiction.

END OF SECTION

22 22 13 – PLUMBING ACCESSORIES & FITTINGS**PART 1 GENERAL – not used****PART 2 PRODUCTS****2.1 ROOF DRAINS**

- A. Assembly: ANSI A112.21.2.
- B. Body: Lacquered cast iron with sump.
- C. Strainer: Removable cast iron dome.
- D. Accessories: Coordinate with roofing type, refer to Section 07 55 00.
 - 1. **Membrane flange and membrane clamp with integral gravel stop.**
 - 2. **Adjustable under deck clamp.**
 - 3. **Roof sump receiver.**
 - 4. **Waterproofing flange.**
 - 5. **Controlled flow weir.**
 - 6. **Leveling frame.**
 - 7. **Adjustable extension sleeve for roof insulation.**
 - 8. **Perforated or slotted ballast guard extension for inverted roof.**
 - 9. **Perforated stainless steel ballast guard extension.**
- E. Acceptable Product: Josam Model 21500.

2.2 ROOF OVERFLOW DRAINS

- A. Lacquered cast iron body and clamp collar [and bottom clamp ring]; pipe extended to 2 inches above flood elevation.
- B. Acceptable Product: Josam Model 21500.

2.3 FLOOR DRAINS

- A. Floor Drain (FD-1):

1. **ANSI A112.21.1; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.**
2. **Acceptable Products: Refer to Drawings.**

2.4 FLOOR SINKS

A. Floor Sink (FS-1):

1. **Square PVC body with integral seepage pan, PVC interior, aluminum or PVC dome strainer, and loose set PVC grate.**
2. **Acceptable Product: Refer to Drawings.**

2.5 CLEANOUTS

A. Exterior Surfaced Areas (CO-1):

1. **Round cast nickel bronze access frame and non-skid cover.**
2. **Exterior Surfaced Areas (CO-1):**
3. **Acceptable Product:**
 - a. **Josam Model 56000.**

B. Exterior Unsurfaced Areas (CO-2):

1. **Line type with lacquered cast iron body and round epoxy coated gasketed cover.**
2. **Acceptable Product:**
 - a. **Josam Model 56010.**

C. Interior Finished Floor Areas (CO-3):

1. **Lacquered cast iron body with anchor flange, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.**
2. **Acceptable Products: Refer to Drawings.**

D. Interior Finished Wall Areas (CO-4):

1. **Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.**
2. **Acceptable Product: Refer to Drawings.**

2.6 HYDRANTS

A. Wall Hydrant:

1. **ANSI/ASSE 1019; non-freeze, self-draining type with chrome plated wall plate hose thread spout, handwheel, and integral vacuum breaker.**
2. **Acceptable Products: Refer to Drawings.**

2.7 BACKFLOW PREVENTERS

A. Refer to schedule on Drawings.

2.8 WATER HAMMER ARRESTORS

- ### A. ANSI A112.26.1; copper construction, piston type sized in accordance with PDI WH-201, precharged suitable for operation in temperature range 34 to 250 degrees F and maximum 150 psi working pressure.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Pipe relief from backflow preventer to nearest drain.

- F. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories and sinks.

- G. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

END OF SECTION

ELKAY[®]

SPECIFICATIONS

GENERAL

Pedestal steel bottle filler with textured power coat finish and E-Coat immersion for year-round beauty with minimum maintenance. The E-Coat immersion process coats the outside and inside of the unit for the ultimate in corrosion protection.

Configuration options:

- Single bottle filler in upper location with drinking fountain basins at middle & lower positions (Model LK4430BF1U)
- Single bottle filler in middle location with drinking fountain basins at upper & lower positions (Model LK4430BF1M)
- Single bottle filler in lower location with drinking fountain basins at upper & middle positions (Model LK4430BF1L)
- Bottle fillers in upper & lower locations with drinking fountain basin at middle position (Model LK4430BF2UL)
- Bottle fillers in upper & middle locations with drinking fountain basin at lower position (Model LK4430BF2UM)
- Bottle fillers in middle & lower locations with drinking fountain basin at upper position (Model LK4430BF2ML)
- Triple bottle fillers (Model LK4430BF3)

NO LEAD DESIGN

This fountain is certified by WQA to lead-free compliance including **NSF/ANSI 61 and 372**.

This model complies with the lead-free definition in the Safe Drinking Water Act of 1986 and Lead Contamination Act of 1988.

CONSTRUCTION

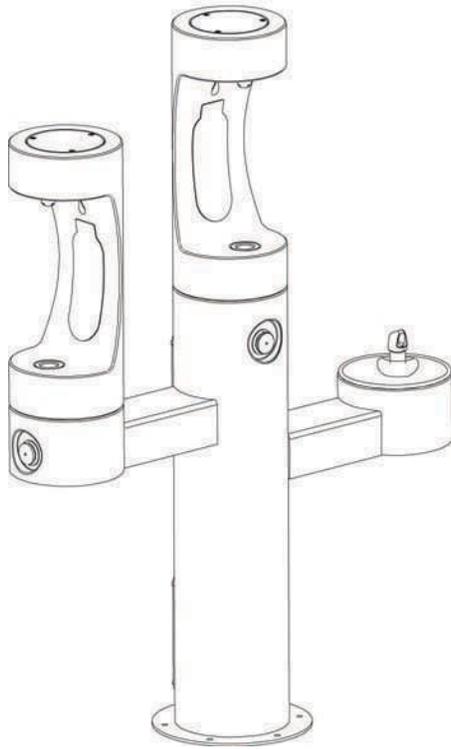
Bottle Filler: Heavy-duty steel construction with rounded design. Laminar flow minimizes splash and allows easy maintenance. Quick fill rate at 1 gallon per minute.

Pushbutton Actuation Mechanism: Self-closing, vandal-resistant pushbutton does not require grasping or twisting.

Inlet Strainer: Easily cleaned in-line strainer screen traps particles of 140 microns or larger before they enter the waterway.

Access Panel: Manufactured of heavy-gauge steel with vandal-resistant screws. Provides access for easy hook-up of all plumbing connections.

**Tri-Level Outdoor Tubular Bottle Filling Station Model
LK4430BF**



Model LK4430BF2UM Shown



This model is ADA compliant when properly installed.

Designed to be easily accessible to both physically challenged and able-bodied individuals. Ideally suited for installation in public areas. Model meets state and federal requirements as defined by the Americans with Disabilities Act.

SUGGESTED SPECIFICATIONS

Unit shall be of tubular steel construction. Bottle Filler unit shall include laminar flow and front pushbutton activation. Stainless steel contoured basin with vandal-resistant one-piece bubbler, if applicable. Shall comply with ADA guidelines and be certified to lead-free compliance including NSF/ANSI 61, CA 1953 and the Safe Drinking Water Act.

Shipping Weight: 280, 330, or 380 lbs.

In keeping with our policy of continuing product improvement, Elkay reserves the right to change product specifications without notice.

This specification describes an Elkay product with design, quality and functional benefits to the user. When making a comparison of other producers' offerings, be certain these features are not overlooked.

Elkay

elkayusa.com

2222 Camden Court
Oak Brook, IL 60523

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(5/13)

**Outdoor Tri-Level Tubular
Bottle Filling Station/Fountain
Model LK4430BF1
(Single Bottle Filler & 2 Fountain Basins)**



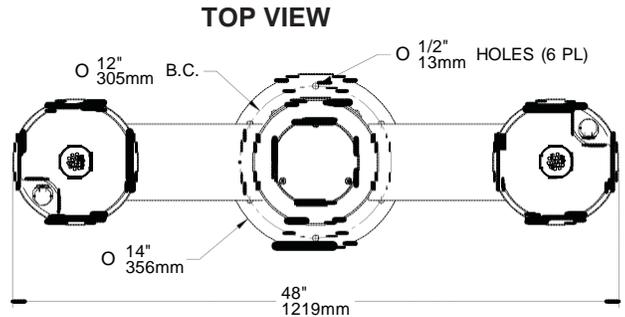
**MOUNTING INSTRUCTIONS and
PLUMBING CONNECTIONS**

Mount on a smooth, flat, finished surface with adequate support (300 lb. load maximum). Secure unit with six 3/8" minimum screws or anchor bolts (not provided). Refer to rough-in.

Water supply 3/8" O.D. unplated copper tube. Waste 1-1/2" IPS.

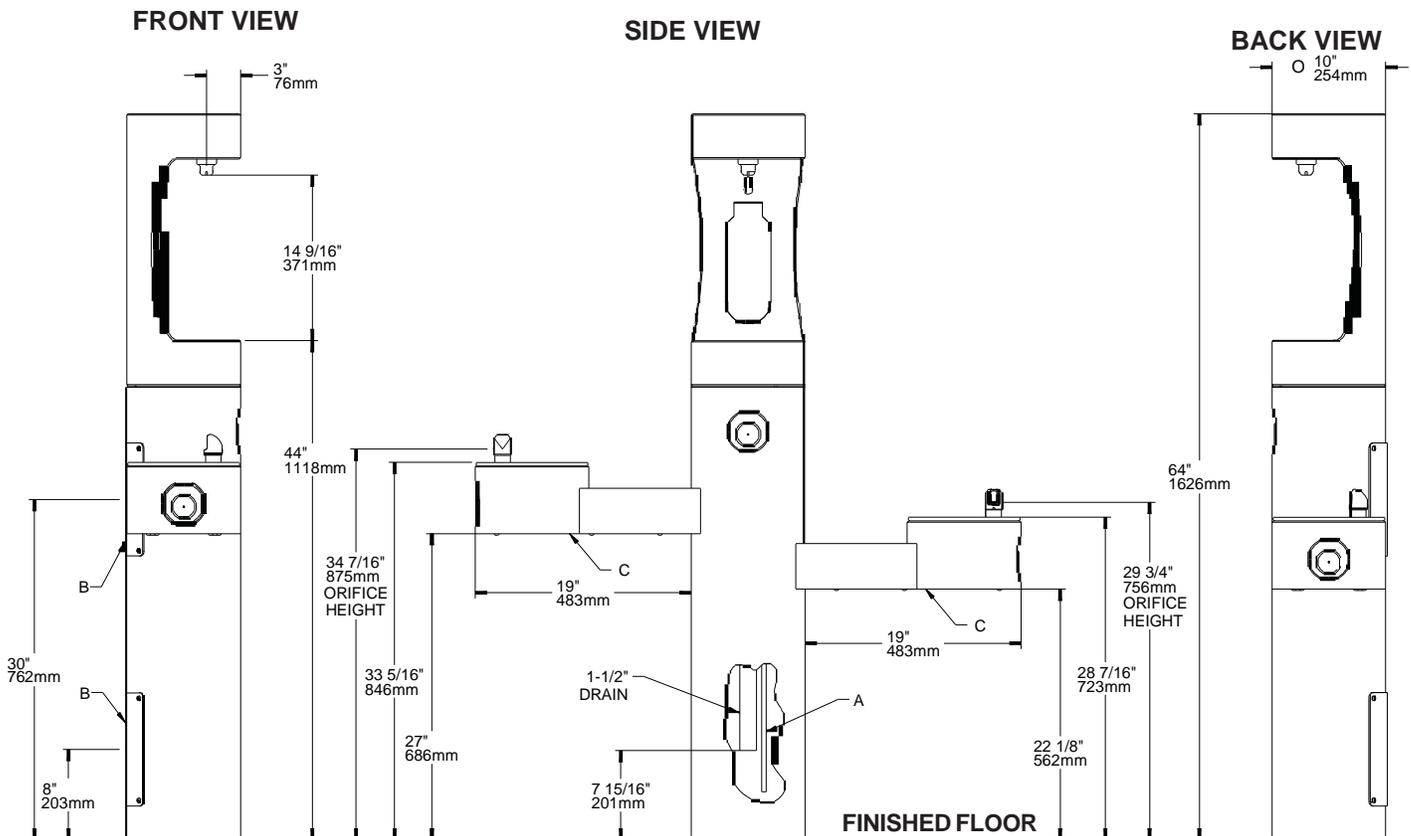
Trap and service stop not included.

Operating Pressures: Supply water: 20 - 105 psi maximum.



ACTUAL PRODUCT CONFIGURATION WILL VARY BASED ON MODEL ORDERED.

**1U = Upper Position; 1M = Middle Position; 1L = Lower Position
MODEL LK4430BF1U SHOWN BELOW**



LEGEND

A = 3/8" O.D. UNPLATED COPPER TUBE CONNECT - SHUT OFF VALVE BY OTHERS

B = ACCESS PANEL (8" X 10")

C = REMOVABLE BOTTOM COVER

(2 Bottle Fillers & 1 Fountain Basin)

ROUGH-IN DIMENSIONS

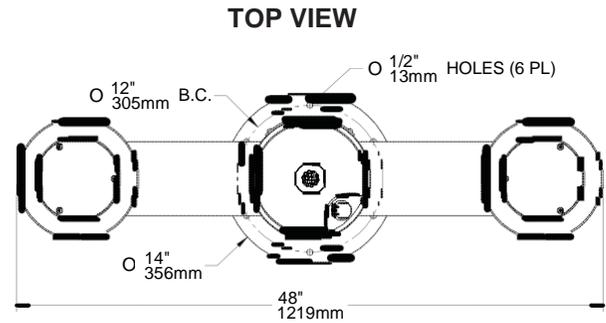
MOUNTING INSTRUCTIONS and PLUMBING CONNECTIONS

Mount on a smooth, flat, finished surface with adequate support (300 lb. load maximum). Secure unit with six 3/8" minimum screws or anchor bolts (not provided). Refer to rough-in.

Water supply 3/8" O.D. unplated copper tube. Waste 1-1/2" IPS.

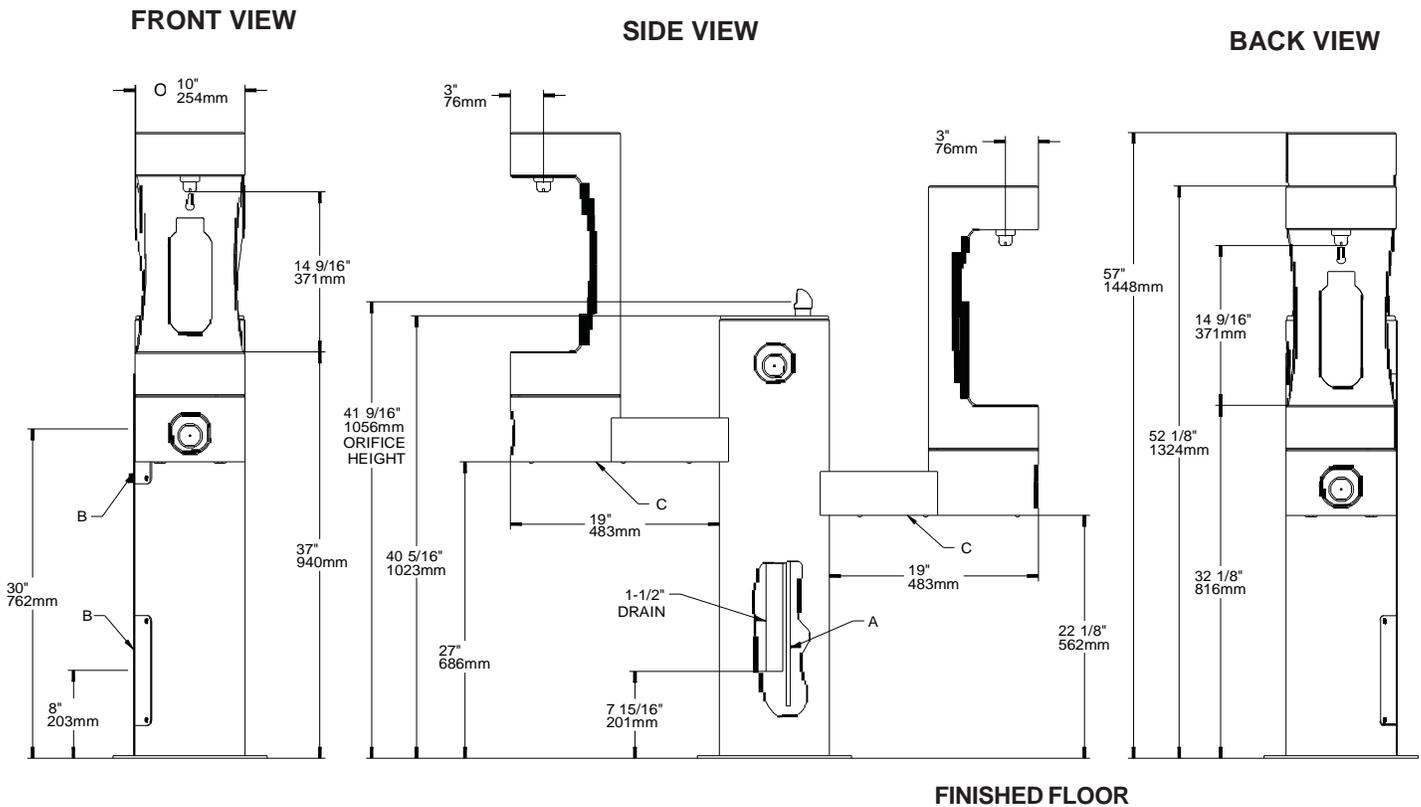
Trap and service stop not included.

Operating Pressures: Supply water: 20 - 105 psi maximum.



ACTUAL PRODUCT CONFIGURATION WILL VARY BASED ON MODEL ORDERED.

**2UM = Upper/Middle Position; 2UL= Upper/Lower Position; 2ML = Middle/Lower Position
MODEL LK4430BF2ML SHOWN BELOW**



LEGEND

- A = 3/8" O.D. UNPLATED COPPER TUBE CONNECT - SHUT OFF VALVE BY OTHERS**
- B = ACCESS PANEL (8" X 10")**
- C = REMOVABLE BOTTOM COVER**

(3 Bottle Fillers)

ROUGH-IN DIMENSIONS

MOUNTING INSTRUCTIONS and PLUMBING CONNECTIONS

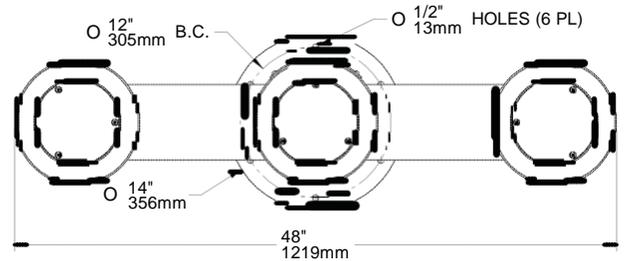
Mount on a smooth, flat, finished surface with adequate support (300 lb. load maximum). Secure unit with six 3/8" minimum screws or anchor bolts (not provided). Refer to rough-in.

Water supply 3/8" O.D. unplated copper tube. Waste 1-1/2" IPS.

Trap and service stop not included.

Operating Pressures: Supply water: 20 - 105 psi maximum.

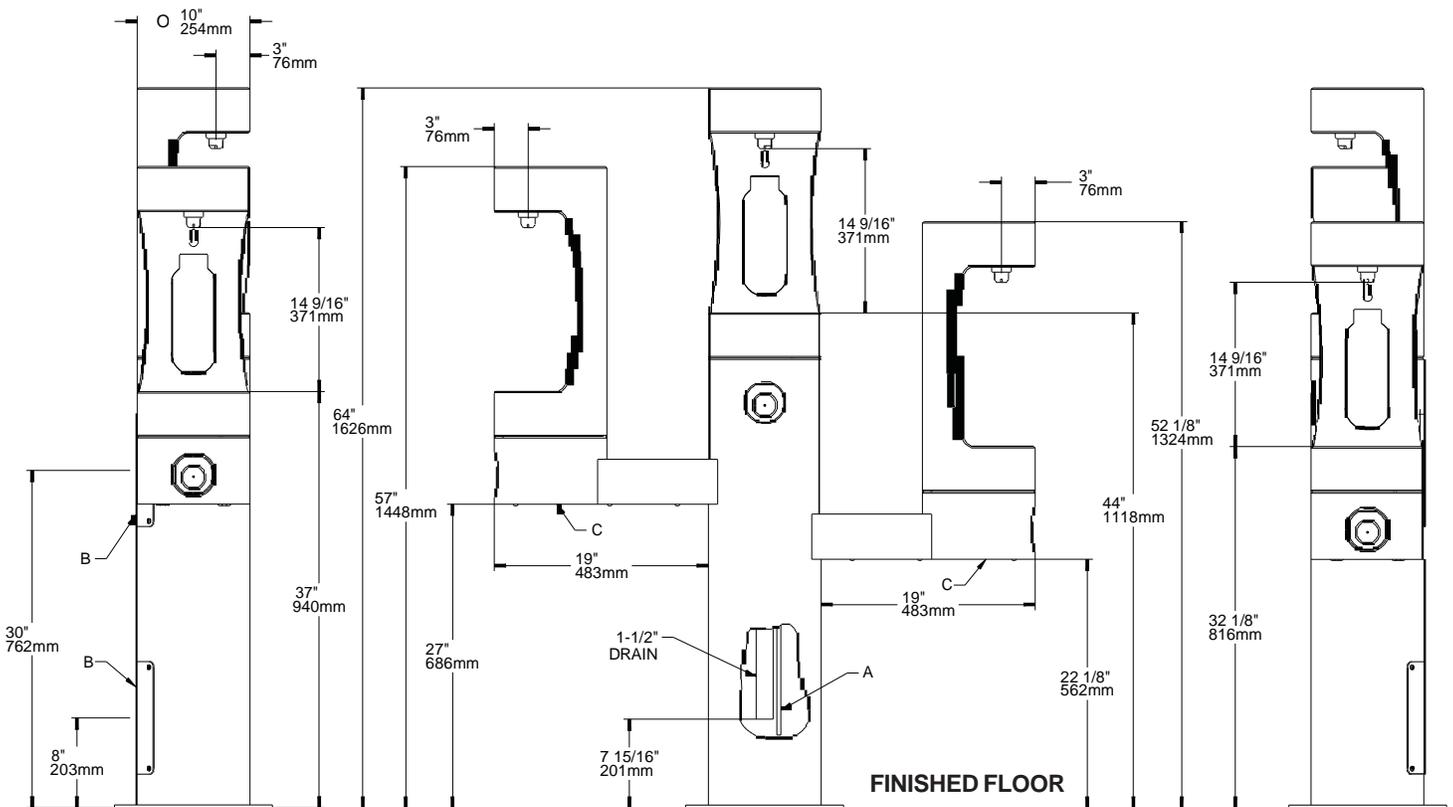
TOP VIEW



FRONT VIEW

SIDE VIEW

BACK VIEW



LEGEND

**A = 3/8" O.D. UNPLATED COPPER TUBE CONNECT - SHUT OFF
VALVE BY OTHERS B = ACCESS PANEL (8" X 10")**

C = REMOVABLE BOTTOM COVER

22 41 00 – PLUMBING FIXTURES

PART 1 GENERAL

1.1 SUBMITTALS FOR REVIEW

- A. Refer to Section 01 33 00 for procedures for submittals.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

1.2 SUBMITTALS FOR INFORMATION

- A. Refer to Section 01 33 00 for procedures for submittals.
- B. Manufacturer's Instructions: Indicate installation methods and procedures.

PART 2 PRODUCTS

2.1 ACCEPTABLE PRODUCTS

- A. Refer to schedule on Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid or flexible supplies to fixtures with [screwdriver] stops, reducers, and escutcheons.

- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall carriers and bolts.
- E. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 92 00, color to match fixture.
- F. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.4 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.5 CLEANING

- A. Clean plumbing fixtures and equipment.

3.6 PROTECTION OF FINISHED WORK

- A. Do not permit use of fixtures during construction.

END OF SECTION

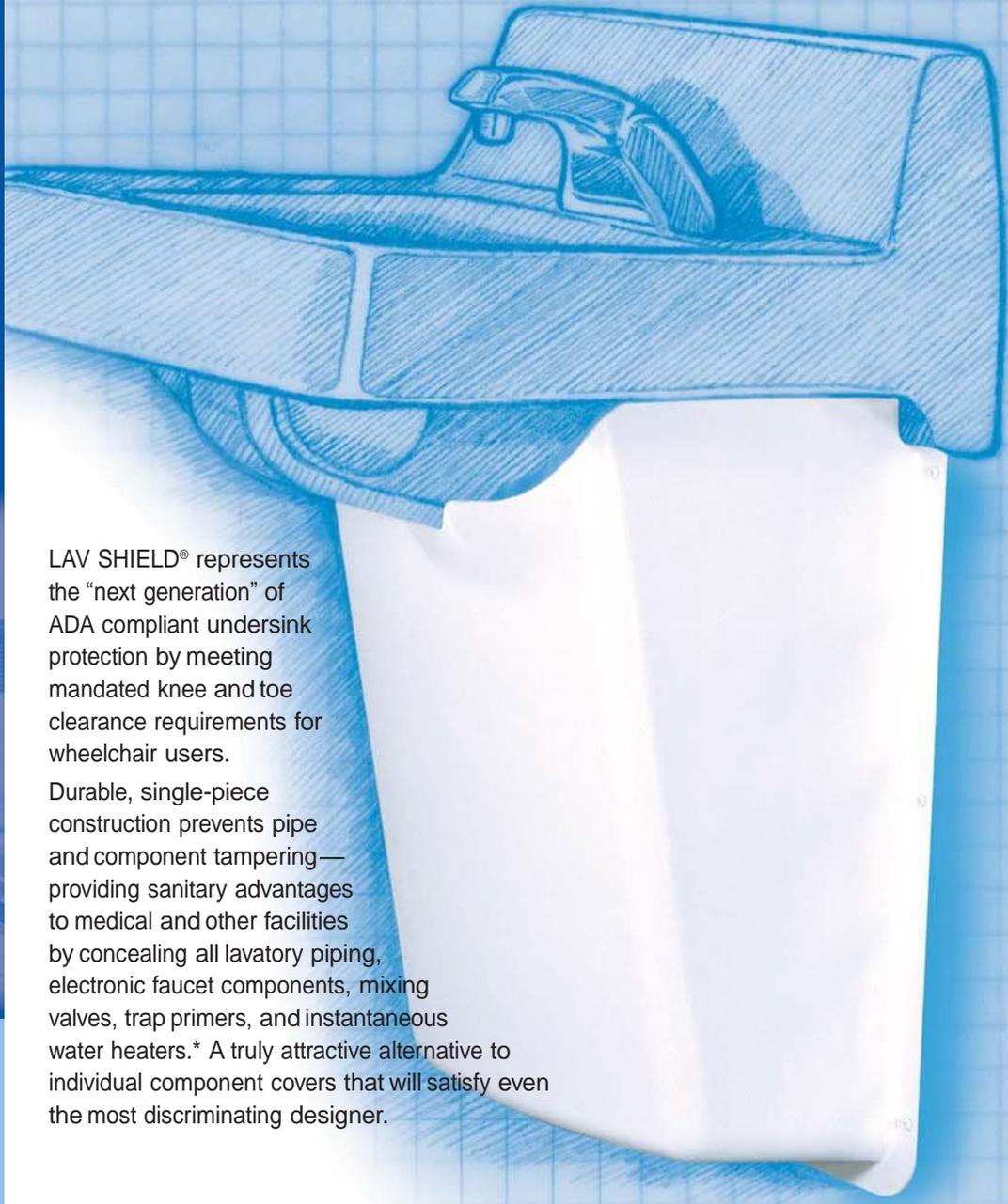
®



**ADA-
engineered
protective
lavatory
enclosure**



LAV SHIELD
LAVATORY PROTECTIVE ENCLOSURES



Architects and engineers specify LAV SHIELD to meet important ADA undersink requirements while enhancing aesthetic appeal.

Since 1990, we at TRUEBRO, INC. have concentrated our efforts on "Making America Accessible" by creating products that address ADA-mandated undersink wheelchair accessibility.

Specifying TRUEBRO is your assurance of protecting people with disabilities while providing quality, durability, and improved aesthetics.

LAV SHIELD® represents the "next generation" of ADA compliant undersink protection by meeting mandated knee and toe clearance requirements for wheelchair users.

Durable, single-piece construction prevents pipe and component tampering—providing sanitary advantages to medical and other facilities by concealing all lavatory piping, electronic faucet components, mixing valves, trap primers, and instantaneous water heaters.* A truly attractive alternative to individual component covers that will satisfy even the most discriminating designer.



TRUEBRO®

IPS CORPORATION





Features and Benefits:

ADA-conforming attractive profile is aesthetically refreshing.

The LAV SHIELD tastefully conceals all unsightly plumbing and mechanical components from view while satisfying ADA dimensional requirements.



Exposed

Enclosed

“Total enclosure” design protects lavatory components from tampering.

Heavy-duty, vandal-resistant enclosure shields all piping, electronic faucet components, mixing valves, trap primers, and instantaneous water heaters.* Vandal-resistant fasteners are also available upon request.

Sanitary advantages for medical facilities.

LAV SHIELD contains an antimicrobial additive to resist fungal and bacterial growth making the LAV SHIELD an excellent cover to use in medical and health care facilities. Installing LAV SHIELD in these facilities eliminates the need to sanitize P-Traps, angle stops, supply lines and electrical components under the sink.

Wide variety of custom options available.

Available in our standard field fit model which allows contractor to custom fit LAV SHIELD to underside of lavatory. For an even faster and more tailored fit, LAV SHIELD can be purchased factory pre-cut to the underside geometry of the actual lavatory being installed. Pre-cut models are listed at right.

Easy-to-service single-piece configuration.

The LAV SHIELD may be quickly removed for convenient, unhindered access to all plumbing and mechanical components. Reinstallation takes just minutes.

High-impact, UV-protected vinyl

Specifications:

Material	Rigid high-impact, stain-resistant PVC
Nominal Wall	.093"
Finish	Fine haircell
UV Protection	Will not fade or discolor
Durability	Virtually indestructible - tamper resistant screws available
Fasteners	7 stainless steel screws and wall anchors provided
Color	China white
Compatibility	Fits all ADA-conforming 20" x 18" wall-hung china lavatories
Paintability	Acrylic enamel or latex
UL Listing	In accordance with ADA Article 4.19.4
Flammability	UL-94 V-0, 5VA ASTM D-635-91 4 (ATB) 2.1 (AEB)
Bacterial/Fungal Resistance	ASTM G21 and G22 — Result 0

TRUEBRO reserves the right to changespecification changes without notice.

Custom Factory Pre-cut Models:

- Model #2018-AS-C – Am.Std. Comrade
- Model #2018-AS-D – Am.Std. Declyn
- Model #2018-AS-L – Am.Std. Lucerne
- Model #2018-AS-M – Am.Std. Muro
- Model #2018-AS-OL – Am.Std. Old Lucerne
- Model #2018-AS-R – Am.Std. Roxalyn
- Model #2018-BD-I – Bradley Imperial
- Model #2018-BR-M – Briggs Milton
- Model #2018-BR-W – Briggs Whitman
- Model #2018-CR-H – Crane Harwich
- Model #2018-CR-N – Crane Norwich
- Model #2018-CR-W – Crane Westmont
- Model #2018-CR-Y – Crane Yorkshire
- Model #2018-EL-B – Eljer Blair
- Model #2018-EL-D – Eljer Delwyn
- Model #2018-EL-M – Eljer Mayburne
- Model #2018-EL-S – Eljer Signature
- Model #2018-EL-U – Eljer Bucknell
- Model #2018-GR-H – Gerber Hayes
- Model #2018-GR-P – Gerber Plymouth
- Model #2018-KO-C – Kohler Chesapeake
- Model #2018-KO-G – Kohler Greenwich
- Model #2018-KO-H – Kohler Hudson
- Model #2018-KO-K – Kohler Kingston
- Model #2018-KO-P – Kohler Pinoir
- Model #2018-KO-S – Kohler Soho
- Model #2018-MA-H – Mansfield 2018 HB
- Model #2018-MA-NS – Mansfield 2018 HB-NS
- Model #2018-TO-L – Toto LT307
- Model #2018-VT – Vitra 5072-003-0030

Suggested Specification:

ADA-conforming, 20" x 18" Wheelchair Accessible Lavatories shall be equipped with the molded TRUEBRO, INC. LAV SHIELD protective lavatory enclosure Model #2018. LAV SHIELD is available standard or pre-cut at the factory upon specification:

■ **LAV SHIELD Standard (Field Fit)**

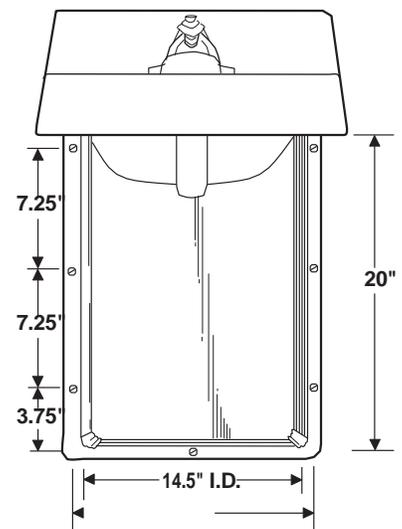
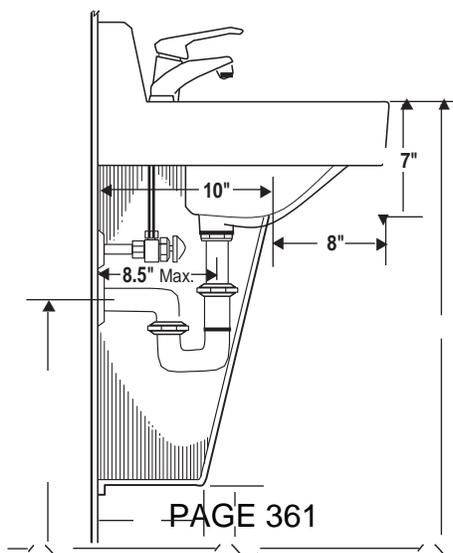
■ **LAV SHIELD Factory Pre-cut**

(List model # and lavatory make from list at left.)

Model # _____

Make _____

Note to specifier: The LAV SHIELD should only be specified in combination with ADA-conforming 20" x 18" wall-hung china lavatories.



□ City of Rancho Mirage
maximizes product life cycle.

City Project No. CP15-315

Rancho Mirage Observatory □

The LAV SHIELD is molded from impact-resistant, stain-resistant and chemical-resistant rigid vinyl for durability, safety and long life.

Strict code compliance minimizes risk.

The LAV SHIELD complies with ADA article 4.19.4, California Title 24, ANSI A117.1, BOCA P 1203.4, and other state and local regulations.

Minimum
22"
rough-in
height of drain**

6" 10"

Note to specifier: The LAV SHIELD should only be specified in combination with ADA-conforming 20" x 18" wall-hung china lavatories.

34" ————— 16"
▼ (center line of screw holes)



*Lavatory "rough in" should be considered to allow mounting room for instantaneous water heater behind enclosure. Contact TRUEBRO for specifications.

7/07

** Less than 22" rough-in height, certain job conditions or certain lavatories may require an offset tailpiece or offset grid strainer.

LAV SHIELD CLASSIFIED BY UNDERWRITERS LABORATORIES, INC.®
IN ACCORDANCE WITH ADA article 4.19.4 22FF



e-mail: info@truebro.com Internet: <http://www.truebro.com>

U.S. and Canadian Patents:

D373,412, D372,077, D384,732, D393,700, D390,643, 79,064, 79,063

23 00 00 – Heating, Ventilating & A.C.**PART 1 - GENERAL****1.1 SUMMARY OF WORK**

- A. Furnishing of all labor, materials, tools, transportation, services, and related items necessary to complete the installation of the HVAC system as illustrated on the drawings, together with all necessary auxiliaries and appurtenances.
- B. **CAL Green:** Comply with all mandatory and specific features required on California Title 24 Energy Acceptance Forms and Commissioning criteria.
 - 1. HVAC systems shall be sized, designed, and equipment selected using the following methods:
 - a. Heat Loss and Heat Gain: ACCA Manual J or ASHRAE handbooks
 - b. Duct systems are sized according to ACCA 29-D Manual D, or ASHRAE handbooks.
 - c. Select equipment according to ACCA 36-S Manual S or equivalent software.
 - d. Note: Air conditioning equipment must be manufactured after 1/1/2015 meeting the applicable minimum efficiency values as determined by Title 20 California Code of Regulations Section 1605.1. State Standards are the same as Federal regulations pursuant to NAECA or EP-Act which prevents the sale of unapproved or unlisted appliances.
 - 2. HVAC crucial compliance measures (include submittals proving compliance)
 - e. Equipment must meet efficiency requirements T24 110.2-A through 110.2-K.
 - f. All units with economizers are to be equipped with Fault Detection and Diagnostics systems.
 - g. Verify that the mechanical heating and cooling equipment are the smallest size, within the available options of the desired equipment line, necessary to meet the design heating and cooling loads of the building, as calculated according to the requirements of Section a40.4(b) T24.
 - h. Verify HVAC motors for fans that are less than 1 hp and 1/12 hp or greater are ECM or have a minimum motor efficiency of 70%. Motors also have means to adjust motor speed for balancing or remote control.
 - i. Each zone shall be controlled by an individual thermostatic control. Controls shall be capable of setting temperatures to 55 degrees F for heating and 85 degrees F for cooling and provide a temperature dead-band of at least 5 degrees F if controlling both heating and cooling.

- j. Each space conditioning system shall be equipped with controls to shut the system off during periods of nonuse to maintain setback and setup temperatures while keeping ventilation dampers closed.
 - k. Outdoor air supply and exhaust equipment shall be installed with dampers that automatically close upon fan shutdown.
 - l. Zone controls are to prevent reheating, re-cooling and simultaneous provisions of heating and cooling the same zone.
 - m. Wall mounted thermostats are to be located away from potential sources that would adversely affect the reading (close to copiers, direct sunlight, below or above a supply air diffuser or convactor, etc.). Any thermostat mounted on exterior wall shall be sealed and in an insulated junction box.
 - n. A corner office design must always have their own thermostat.
 - o. Sequence of operations shall be listed for equipment operations (stand-alone packaged controls. Unoccupied sequences should be included.
3. HVAC ventilation rates to comply as follows:
- a. Outdoor air-ventilation rate and air-distribution assumptions made in the installation of the ventilation system shall be in compliance with requirements in T24 regulations.
 - b. Each space requires natural ventilation or mechanical ventilation that is no less than the larger of conditioned floor area times the requirements in Table 120.1-A or 15 cfm times the expected number of occupants.
 - c. Minimum and maximum outdoor air rates for each unit must comply with T24 energy standards. The rates shall be based on planned occupancy as defined in owner's design intent and are not based on maximum egress occupancy rates.
4. HVAC demand control ventilation (DCV)
- d. HVAC systems must have an economizer, serve a space with a design occupant density greater than or equal to 25 people per 1000 sf, and are either a single zone system with any controls or multiple zone system with DDC controls to the zone level which must have controls and meet the following:
 - 1. CO2 sensors installed in each room served by the systems with DCV controls
 - 2. CO2 sensors located 3 ft and 6 ft above the floor
 - 3. CO2 concentrations maintained at less than or equal to 600 ppm plus outdoor ppm
 - 4. During hours of expected occupancy, controls maintain the system ventilation rate.
5. HVAC Economizers
- e. Each cooling fan system that has a design mechanical cooling capacity over 54,000 Btu/h must have an air economizer or a water economizer. Air economizers must shall comply with high limit shutoff controls per T24 table 140.4-B.

- f. Sequence of operation shall be submitted for integrated economizer controls that are set up such that partial cooling is provided by the economizer even when additional mechanical cooling is required.
- g. Economizer dampers are to be driven by direct drive actuators rather than rod linkages, which can be a major cause of economizer malfunction.
- h. Barometric relief to be used if possible or relief fans (rather than return fans).
- i. Outdoor and return air sensors shall be properly selected and located to provide accurate and repeatable measurements for controlling economizer operation. Averaging sensors cover the entire duct or call face areas.

6. HVAC ducting

- a. All air distribution system ducts and plenums must be installed, sealed and insulated as required by T24 120.4(a)
- b. Duct sealing leakage rates must be in compliance with T24 standards.

1.2 SCOPE OF WORK: Items include but are not limited to the following:

- Packaged rooftop unit.
- Heat exchanger.
- Refrigeration components.
- Unit operating controls.
- Air filters.
- Roof curb.
- Electrical power connections.
- Operation and maintenance service.
- Ductwork.
- Ductwork specialties.
- Access panels and doors.
- Ductwork insulation.

1.3 SUBMIT PRODUCT DATA.

A. Submit Shop Drawings, including mounting and installation details for roof curbs and coordination with roofing system.

B. References

1. ASHRAE 90.1-2001 - Energy Standard for Buildings. Establishes minimum efficiencies for equipment.

2. NFPA 90 A & B - Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems.
3. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
4. ARI 360 - Commercial and Industrial Unitary Air Conditioning Equipment testing and rating standard. Applies to Gas/Electric Units above 135,000 BTU.
5. ANSI/ASHRAE 37 - Testing Unitary Air Conditioning and Heat Pump Equipment.
6. ANSI Z21.47/UL1995 - Unitary Air Conditioning Standard for safety requirements.
7. ARI 210/240 - Unitary Air Conditioning Equipment and Air- Source Heat Pump Equipment. Applies to all units below 135,000 BTU.
8. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
9. ARI 370 - Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment.
10. ANSI/NFPA 70-1995 - National Electric Code.

- C. EER: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Building, except Low-Rise Residential Buildings."

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Install packaged units, as indicated in the Drawings, in accordance with the Manufacturer's instructions and requirements. Provide related products and accessories from one manufacturer. Store materials in accordance with manufacturer recommendation protecting from dirt, moisture, contaminants and weather.
- B. Codes and Standards: Perform all installations in accordance with the latest standards as recognized by ASHRAE, SMACNA and all applicable state and local codes and ordinances.
- C. Workmanship: Experienced, well-trained workers competent to complete the work as specified shall perform Labor in conformance with generally accepted trade standards. Install all equipment square and plumb allowing access for proper operation, adjustment and service.

1.5 STRUCTURAL AND SPACE CONDITIONS

- A. All work shall avoid obstructions and interference with other trades, preserve headroom and keep openings and passageways clear and free.

1.6 VIBRATION AND NOISE

A. Install each of the various pieces of equipment to operate without objectionable vibration or noise.

1.7 BALANCING AND TESTING

A. Test and Balance shall be performed by a nationally qualified Test and Balance Company contracted directly by the Contractor.

B. Contractor shall coordinate testing with the Testing and Balance Company. All systems shall be fully operational prior to commencement of testing. Correct all deficiencies noted in the Test and Balance Report within three days or prior to occupancy.

C. Assume responsibility for correcting all items determined to be the result of improper or incomplete installation.

D. Contractor shall be responsible for providing test reports to the owner's commissioner and to local jurisdiction as required for Certificate of Occupancy.

E. **CAL Green:** Required for Commissioning
"Zero Defect" Test and Balance Program.
National Consultants: Test and Balance Corporation
Melink Corporation
Awarded Global
Refer to the Scope of Works Documents, section 00 02 00, for instructions and contact information.

1.8 CLEAN-UP

A. At the completion of the work, clean the area of all debris such that the Project is left in a neat and clean manner as deemed acceptable by the Owner.

1.9 WARRANTY

A. In addition to honoring all Contractor supplied equipment manufacturers' warranties, the Contractor shall warrant and correct all defects in Contractor supplied material and all workmanship for a period of one (1) year after acceptance of Project by the Owner. Warranty costs shall include all labor and material associated with the correction of work covered under this Contract.

PART 2 - PRODUCTS

2.1 ROOF TOP AIR CONDITIONING UNITS, FANS AND AIR OUTLETS

- A. Equipment shall be as indicated on the Drawings. Air conditioning unit shall include hard-start kit for low ambient temperature operation.

Packaged Rooftop Electric Cooling Unit with Gas Heat — Constant Volume Application

Size Range: 3 to 12 1/2 Tons, Nominal (Cooling)

60,000 to 250,000 Btuh, Nominal (Input Heating)

Carrier Model Numbers: 48HJD/L/G, 48HJE/M/H, 48HJF/N/K

- B. The manufacturer shall include the following items:

1. 5-year compressor warranty - parts only.
2. 10-year heat exchanger warranty - parts only.
3. Factory installed two-position motorized damper.
4. Factory installed hard start kit for low ambient to zero degree operation.
5. Factory installed hinged access panels.
6. Through the base gas and electrical connections to minimize roof penetrations.
7. Factory installed circuit breaker.
8. Factory installed unpowered convenience outlet.
9. Factory supplied / field installed supply air smoke detector.

2.2 ROOFTOP W/ ELEC. COOL & GAS HEAT , CONSTANT VOLUME, COMMUNICATING, PRODUCT INTEGRATED CONTROL (PIC), SEQUENCE OF OPERATION.

- A. The contractor shall furnish manufacturer complete submittal wiring diagrams of the packaged unit as applicable for field maintenance and service.

B. Sequence of Operation Description

1. Outdoor rooftop mounted, Microprocessor controlled, heating and cooling unit utilizing a hermetic compressor(s) for cooling duty and gas combustion for heating duty. Unit shall discharge supply air vertically or horizontally as shown on contract drawings. Rooftop communicates with and sends alarms to, the building automation network and alarm printer.

2.3 CONTROLS AND SAFETIES FOR CARRIER MODELS

A. Unit Controls:

Unit shall be complete with self-contained low voltage control circuit protected by a fuse on the 24 V transformer side (008-014 units have a re-settable circuit breaker).

B. Safeties:

Unit shall incorporate a solid-state compressor protector which provides anti-cycle reset capability at the space thermostat, should any of the following standard safety devices trip and shut off compressor.

1. Compressor over temperature, over-current
2. Loss-of-charge/low-pressure switch
3. Freeze-protection thermostat, evaporator coil
4. High-pressure switch
5. Automatic reset motor thermal overload protector.
The lockout protection shall be easily disconnected at the control board, if necessary.

C. Heating section shall be provided with the following minimum protections:

1. High-temperature limit switches
2. Induced draft motor speed sensor
3. Flame rollout switch
4. Flame proving controls.

NOTE: Certain features are not applicable when the features designated * are specified. For assistance in amending the specifications, contact your local Carrier Sales Office.

D. *Carrier PremierLink™ Controls:

1. Shall be available as a factory-installed or as a field-installed accessory.
2. Shall work with CCN and ComfortVIEW™ software.
3. Shall be compatible with ComfortLink™ controllers.
4. Shall be ASHRAE 62-99 compliant.
5. Shall accept a CO2 sensor in the conditioned space - Demand Control Ventilation (DCV)
6. Shall have baud communication rate of 38.4K or faster.
7. Shall be Internet ready.
8. Shall include an integrated economizer controller.
9. If an economizer is specified, the “EconoMi\$er2 with 4–20 mA actuator and no microprocessor control” is required.

E. *Integrated Economizers:

Integrated integral modulating type capable of simultaneous economizer and compressor operation. Economizer operation, only compressor no. 1 on sizes 008-014 will operate.

1. Available as a factory-installed option in vertical supply/return configuration only. (Available as a field-installed accessory for horizontal and/or vertical supply return

2. Includes all hardware and controls to provide cooling with outdoor air.
3. Equipped with low-leakage dampers, not to exceed 2% leakage at 1 in. wg. pressure differential.
4. Capable of introducing up to 100% outdoor air.
5. EconoMi\$er2 shall be equipped with a barometric relief damper.
6. Designed to close damper(s) during loss of power situations with emergency power supply (Durablade economizer) or spring return built into motor (EconoMi\$er2).
7. Dry bulb outdoor air temperature sensor shall be provided as standard. Outdoor air sensor opens at 67°F, closes at 52°F and is non-adjustable. Enthalpy, differential temperature (adjustable), and differential enthalpy control shall be provided as field installed accessories.
8. Durablade economizer is a guillotine-style damper, and the EconoMi\$er2 is gear-driven parallel blade design.
9. EconoMi\$er2 microprocessor control shall provide control of internal building pressure through its accessory power exhaust function. Factory set at 100%, with a range of 0% to 100%.
10. EconoMi\$er2 shall be capable of control from a 4–20 mA signal through optional 4–20 mA design without microprocessor control (required for PremierLink™ or 3rd party control interface).
11. EconoMi\$er2 Microprocessor Minimum Damper Position Setting — potentiometer maintains the minimum airflow into the building during occupied period (damper position during heating).
12. EconoMi\$er2 Microprocessor Maximum Damper Position Setting — potentiometer allows installer to limit the amount of outdoor airflow into the building, when CO2 overrides the mixed air sensor. Setting the maximum position of the damper prevents the introduction of large amounts of hot or cold air into the space.
13. EconoMi\$er2 Microprocessor IAQ control — modulates the outdoor-air damper to provide ventilation based on the optional 2-10 VDC CO2 sensor input.
14. EconoMi\$er2 Microprocessor Purge or Shutdown modes: require optional Honeywell S963B1128 potentiometer (135 ohm).
15. Compressor lockout sensor (opens at 35°F, closes at 50°F).

F. Manual Outdoor Air Damper:

Manual damper package shall consist of damper, birdscreen and rainhood which can be preset to admit up to 50% outdoor air for year round ventilation.

G. *100% Two-Position Damper:

1. Two-position damper package shall include single blade damper and motor.
Admits up to 100% outdoor air.
2. Damper shall close upon indoor (evaporator) fan shutoff.
3. Designed to close damper during loss of power situations.
4. Equipped with 15% barometric relief damper.

H. *25% Two-Position Damper:

1. Two-position damper package shall include single blade damper and motor.
Admits up to 25% outdoor air.
2. Damper shall close upon indoor (evaporator) fan shutoff.

I. *Head Pressure Control Package:

Consists of solid-state control and condenser coil temperature sensor to maintain condensing temperature between 90°F and 110°F at outdoor ambient temperatures down to -20°F by condenser-fan speed modulation or condenser fan cycling and wind baffles.

J. *Electronic Programmable Thermostat:

Capable of using deluxe full-featured electronic thermostat. Shall use built-in compressor cycle delay control for both heating and cooling duty. Capable of working with Carrier direct digital controls.

K. Fan/Filter Status Switch:

Provides status of indoor (evaporator) fan (ON/OFF) or filter (CLEAN/DIRTY). Status shall be displayed over communications bus when used with direct digital controls or with an indicator light at the thermostat.

L. Energy\$Recycler:

The package shall be an outdoor rooftop or surface mounted, electronically controlled, air-to-air heat pump unit utilizing a hermetic compressor for cooling and heating duty. The Energy\$Recycler shall recover energy from building exhaust air and pre-condition ventilation air to allow higher ventilation requirements and minimizing energy cost.

This option shall be available with the following:

1. A mounting kit for the Energy\$Recycler for cantilever mounting off of the rooftop unit with out the use of a slab or a roof curb.
2. A supplementary supply air fan kit to provide increased air movement into the 62AQ unit.
3. A field installed 460 V to 208/230 V transformer to provide power when the 208-230/1/60 62AQ060 or 100 size Energy\$Recycler is used with a 460 V rooftop unit.

M. EconoMi\$er2 and Power Exhaust

Package shall provide control of internal building pressure. The power exhaust system shall exhaust up to 100% of return air (vertical only).

N. Power Exhaust Accessory for EconoMi\$er2

Power exhaust shall be used in conjunction with EconoMi\$er2 to provide

□City of Rancho Mirage City Project No. CP15-315 Rancho Mirage Observatory□
system exhaust of up to 100% of return air (vertical only). The power exhaust is a field-installed accessory (separate vertical and horizontal design).

Note: Horizontal power exhaust is intended to mount in return ductwork. As the outdoor-air damper opens and closes, both propeller fans are energized and de-energized through the end switch (potentiometer) located on the EconoMiSer2 controller. The end switch is factory set at 100% of outdoor air, and is adjustable 0-100% to meet specific job requirements. Available in 208/230-1-60 V or 460-3-60 V. An LED light on the controller indicates when the power exhaust is operating.

o. Outdoor Air Enthalpy Sensor:

The outdoor air enthalpy sensor shall be used with the EconoMiSer2 device to provide single enthalpy control. When used in conjunction with a return air enthalpy sensor, the EconoMiSer2 device will provide differential enthalpy control. The sensor allows the EconoMiSer2 controller to determine if outside air is suitable for free cooling.

p. Return Air Enthalpy Sensor:

The return air enthalpy sensor shall be used with the EconoMiSer2 device. When used in conjunction with an outdoor air enthalpy sensor, the EconoMiSer2 device will provide differential enthalpy control.

q. Return Air Temperature Sensor:

The return air temperature sensor shall be used with the EconoMiSer2 device. When used in conjunction with the standard outdoor air temperature sensor, the EconoMiSer2 device will provide differential temperature control.

r. Outdoor Air/Return Air Temperature Sensor (Adjustable):

Optional sensor uses (4) ranges on EconoMiSer2 microprocessor to control outdoor-air damper and compressor operation.

s. Indoor Air Quality (CO2) Sensor:

1. Shall have the ability to provide demand ventilation indoor air quality (IAQ) control through the EconoMiSer2 with an IAQ sensor.
2. The IAQ sensor shall be available in duct mount, wall mount, and wall mount with LED display. The setpoint shall have adjustment capability.
3. Require EconoMiSer2, PremierLink™, or Apollo control options.

t. MoistureMiSer™ Dehumidification Package:

The dehumidification package is a factory installed option that provides increased dehumidification by further subcooling the hot liquid refrigerant leaving the condenser coil. The package consists of a subcooling coil located on the leaving airside of the evaporator coil. The location of this coil in the indoor air stream greatly enhances the latent capacity of the units.

The package shall be equipped with crankcase heater(s), low pressure switch(es) and thermostatic expansion valve(s) (TXV). Low pressure switch(es) prevents evaporator coil freeze-up and TXVs assure a positive superheat condition.

If the operation of the subcooling coil is controlled by a field-installed, wall-mounted humidistat, the dehumidification circuit will then operate only when needed. Optional field connections for the humidistat are made in the low voltage compartment of the unit control box.

U. Humidistat:

Field-installed, wall-mounted humidistat is used to control activation of the dehumidification package. The humidistat can be set for humidity levels between 20% and 80% relative humidity.

2.2 DUCTWORK

A. Rectangular Ducts Fabrication, General: Except as otherwise indicated, fabricate rectangular ducts with galvanized sheet steel, in accordance with SMACNA - HVAC Duct Construction Standards, Tables 1-3 through 1-19, including their associated details. Conform to the requirements in the referenced standard for metal thickness, reinforcing types and intervals, tie rod applications, and joint types and intervals.

B. Kitchen Hood Exhaust Ducts Fabrication, General: Fabricated using 16-gage, carbon steel sheets for concealed ducts and 16-gage stainless steel for exposed ducts. Weld and flange seams and joints. Conform to NFPA Standard 96.

C. Flexible Ductwork Fabrication, General:

1. Factory preinsulated, spiral helix steel spring permanently bonded to an interior liner, and sheathed in an exterior reinforced laminated vapor barrier jacket.

2. Precut lengths of flexible duct with continuous inner liner, factory installed female collars and fastening devices at each end.

3. Provide spin-in extractor/ balancing damper assembly complete with a level position indicator and positive locking device, as indicated on the Drawings, round duct takeoffs from rectangular main ducts.

D. Label entire assembly in accordance with UL 181 Class 1 air duct requirements and not have a flame and smoke spread rating in excess of 25/50 respectively.

2.3 DUCT ACCESS PANELS AND DOORS

A. In sheet metal work, hollow core double construction of same or heavier gage material as duct in which installed, products by CESCO, Vent Products, Air Balance, or equivalent.

1. Provide Ventlok or approved hinges and latches on all doors; 100 Series hinges and latches on low pressure system doors up to 18-inches maximum dimension, 200 Series on larger low pressure system doors and 333 Series on high pressure systems.

2. Construct doors up to 18-inches maximum dimension with one inch overlap fit and gasket with 3/4-inch by 1/8-inch sponge rubber, fit larger doors against 1-1/2 inches by 1/8-inch flat stock or angle frame and gasket with 3/4-inch by 1/8-inch sponge rubber or felt.

3. Door swing to be opposite airflow direction.

2.4 DUCTWORK SPECIALTIES

A. Volume and Splitter Dampers

1. Galvanized sheetmetal blade and frame with Ventfabrics Inc., Ventlok operating hardware.

2. For accessible dampers, provide #641 self-locking dial regulators and #644 self-locking dial regulators for insulated ductwork, #637 square end bearing, and #635 spring end bearing, as applicable.

3. For inaccessible dampers, provide #666 or #677 concealed locking damper regulator with bearings as above. For static pressures above 3-inch W.G., provide #640 HiVel dial regulator and #609 HiVel end bearing for accessible dampers.

B. Multi-Louver Volume Dampers

1. 16-gauge galvanized steel frame. Opposed, 6-inch wide, 16-gauge galvanized steel blades. Concealed linkage in frame.

2. Titus #AG-35-B, Ruskin #CD35/OBD or equal.

C. Flexible Connections

1. Provide flexible connectors at the discharge and inlet of fans, air handlers, rotating mechanical equipment, and where shown on the Drawings for proper vibration isolation.

2. Neoprene impregnated glass cloth with 24-gauge galvanized metal frame.
Minimum dimensions: 3-inch metal, 3-inch fabric, 3-inch metal.

3. Duro Dyne #MFN4, Ventfabrics "Ventglas", Q Industries, Consolidated Kinetics, Elgen, or equal.

D. Backdraft Dampers

1. Provide counterweight type complete with frame, end bearings, counterbalance assembly, blades, and linkage.
2. Install at outside air intakes, exhaust outlets, and where shown on Drawings.
3. Pacific Air Products #PRD-100AL, Ruskin #CBS-7 or equal by Swartwout, American Warming, or Vent Products.

2.5 DUCT INSULATION

- A. Acceptable Manufacturers: Provide products of the following manufacturers, complying with specified requirements. Equivalent products of other manufacturers will be considered in accordance with the "or equal" provision specified in Section 01000 - Supplemental General Requirements, and the Construction Contract.

1. Owens-Corning Fiberglas Corp.
2. Johns Manville Corp.
3. Certainteed Corp.

- B. All insulation material shall comply with applicable energy conservation regulations for Project location.

- C. Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E84 (NFPA 255) method.

- D. Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

- E. Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

2.6 HVAC CONTROLS

- A. Shall be as indicated on the Drawings.

- B. Electric and electronic HVAC Controls: Components and operating features as indicated on the Drawings.

2.7 ROOF CURB

- A. Manufacturer's standard corrosive-resistant-coated, insulated curb with nailer strip, flashing and counterflashing and cadmium-plated hardware.

PART 3 - EXECUTION

3.1 HVAC SYSTEM INSTALLATION, GENERAL

A. Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements

1. Coordinate mechanical systems, equipment, and materials installation with other building components.

2. Verify all dimensions by field measurements.

3. Arrange for chases, slots, and openings in other building components during progress of, to allow for mechanical installations.

4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

8. Install systems, materials, and equipment to conform with drawings and specs, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Construction Manager for resolution prior to installation.

9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.2 AIR CONDITIONING UNIT INSTALLATION

A. Install in accordance with manufacturer's instructions and comply with the following requirements:

1. Provide layout drawings of units, locations and power requirements to electrical installer.

2. Install minimum 30 percent efficiency air filters in unit during installation phase. Do not operate the unit without filters in place.

3. Mount rooftop unit on factory built roof-mounting frame. Install roof mounting frame level. Secure frame to structural framing and rooftop unit on frame as indicated on the Drawings.

4. Install 3-inch long flexible duct connection at inlets and outlets of units.

5. Install condensate drain piping and traps in accordance with manufacturer's instructions and as shown on the Drawings. All metal piping and supports shall be of same material to prevent electrolysis.

6. Control installers shall install thermostat and all wiring associated with control signals into the units. All thermostats shall be located in manager's office with remote sensors located in appropriate locations in return ductwork.

7. Install all line voltage power wiring and conduit as indicated on the Drawings and as specified in Division 16 - Electrical.

8. Coordinate with Electrical Contractor to install a new set of filters three days prior to Substantial Completion review.

3.4 EXHAUST/SUPPLY FAN INSTALLATION, GENERAL

A. Install fans level and plumb, in accordance with manufacturer's written instructions. Secure roof-mounted fans to roof curbs with cadmium-plated hardware.

B. Provide access space around fans for service and maintenance, as indicated on the Drawings and in compliance with applicable Mechanical Code.

C. Clean unit cabinet interiors to remove foreign material and construction dirt and dust.

D. Coordinate with Electrical Contractor to provide electrical power wiring as specified in Division 16 - Electrical.

3.4 DUCTWORK INSTALLATION

A. Ductwork Installation, General:

1. Ductwork is generally diagrammatically indicated on the Drawings and shall be generally installed as indicated. Do not scale Drawings for exact location of ducts.

2. Install ducts to best suit field conditions and to coordinate with other building components. Do not cut Structural members without consent of Construction Manager. Check with Structural Drawings prior to locating penetrations.

3. Duct sizes are indicated as net inside dimensions on the Drawings. The indicated dimensions shall be altered at the job site for the purpose of avoiding interference and clearance difficulties to other dimensions producing the same air handling characteristics, provided such altered dimensions are approved by the Construction Manager.

B. Hangers and Supports

1. Securely fasten all ducts to building construction by means of hangers, supports, guides, anchors, and sway braces to maintain duct alignment, to prevent sagging, and to prevent noise and excessive strain on ducts due to movement under operating conditions.

2. Adequately mount and anchor all material and equipment as required. Include lateral bracing as required to prevent horizontal, seismic movement. Refer to applicable Mechanical Code requirements and details on Drawings for seismic requirements.

3. Do not support ducts from fans or other equipment.

4. Power-driven fasteners shall not be used to support ducts.

5. Support round duct, 30-inch and larger, with two hangers at each support point.

6. Hangers and supports shall conform to SMACNA section, "Hangers and Supports". Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection using double strap hangers on each side of fitting.

7. Support vertical ducts, passing through roofs with two continuous angles screwed to the duct and bearing to the roof structure, and conforming to SMACNA section "Riser Support-From Floor."

C. Seismic Supports and Bracing

1. Where required, all ductwork and equipment shall be seismically supported and braced per the SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems", including Appendix E.

D. Joints Sealing, General

1. Duct tape shall not be used on duct joints.

2. Transverse joints: All transverse joints including Ductmate type joints on all supply, return, exhaust and outside air intake ducts, sealed using Hardcast Arabol.

3. Interior exposed joints: Seal using water based sealer, Hardcast Iron Grip.

4. Interior concealed joints (above 1-inch W.G. pressure ductwork): Seal using gypsum impregnated tape and adhesive.

5. Interior concealed joints (to 1-inch W.G. pressure ductwork): Seal using water based sealer, Hardcast Iron Grip.

6. Exterior joints (above 1-inch W.G. pressure ductwork): Seal using gypsum impregnated tape and adhesive.

7. Exterior joints (to 1-inch W.G. pressure ductwork): Seal using oil based sealer, Hardcast Galva Grip or equal.

8. Exterior joints: Seal water and to air-tight condition with sealant.

E. Ductwork Painting, General - Where the interior surfaces of ductwork are visible through the blades of supply outlets, return inlets, and exhaust inlets, paint interior visible surfaces with one coat of flat black paint. See Section 09905 - Painting.

F. Cleaning - Clean the inside of plenums, casings, enclosures, fans, and accessible ductwork before starting fans.

3.5 DUCTWORK ACCESSORIES, INSTALLATION

- A. Provide duct-mounted balancing dampers or attached opposed blade dampers so that each diffuser, grille and register may be individually balanced.
- B. Provide unit opposed blade damper where individual duct mounted balancing dampers are not provided.
- C. Provide turning vanes in all mitered elbows in all ducts, so that tips are parallel with the sides of the ducts. Vanes shall be single thickness type with extended trailing edge. Tips of acoustical turning vanes on outside radius shall be flush with acoustical lining.
- D. Provide flexible connections to completely isolate fans from direct contact with all sheet metal work.
- E. Provide access panels or doors, as required, for access to valves, controllers, fire dampers.

3.6 DUCT INSULATION, INSTALLATION

A. Wrapped Ductwork Insulation

- 1. Application Requirements: Insulate the following ductwork as follows:
 - a. HVAC supply ductwork between fan discharge, or HVAC unit discharge, and room terminal outlet.
 - b. HVAC return ductwork between room terminal inlet and return fan inlet, or HVAC unit inlet.
- 2. Insulate each ductwork system specified above with 1-1/2 inches thick insulation and vapor barrier jacket, application limited to concealed locations.
- B. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose and as follows:
 - 1. Install insulation on pipe and ductwork systems subsequent to painting, testing, and acceptance of tests.
 - 2. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
 - 3. Clean and dry pipe or duct surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
 - 4. Maintain integrity of vapor-barrier jackets on pipe and ductwork insulation, and protect to prevent puncture or other damage.
 - 5. Extend pipe and ductwork insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

6. Protect outdoor insulation from weather by installing outdoor protective finish or jacketing as recommended by manufacturer.

7. Replace damaged insulation that cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

8. Insulation installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

3.7 CONTROL SYSTEMS, INSTALLATION

A. Installation

1. Install systems and materials in accordance with manufacturer's instructions and recommendations, rough-in drawings, and details indicated on the Drawings.

2. Coordinate with Electrical Contractor to install electrical components and use electrical products complying with requirements of applicable requirements specified in Division 16 - Electrical.

3. Mount controllers at convenient locations and heights.

B. Control Wiring - The term "control wiring" shall be defined to include providing of wire, conduit and miscellaneous materials as required for mounting and connecting electric control devices.

B. Wiring System

1. Install complete control wiring system for electric control systems.

2. Conceal wiring except in mechanical rooms and areas where other conduit and piping are exposed.

3. Provide multi-conductor instrument harness (bundle) in place of single conductors where number of conductors can be run along common path.

4. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.

D. Start-Up - Start, test and adjust electric control systems in presence of manufacturer's authorized representative. Replace damaged or malfunctioning controls and equipment.

E. Cleaning - Clean factory-finished surfaces. Repair marred or scratched surfaces with manufacturer's touch-up paint.

F. Final Adjustment - After completion of installation, adjust thermostats, control valves, motors and similar equipment specified in this Section. Final adjustment shall be performed by specially trained personnel in direct employ of manufacturer of primary temperature control system.

G. Control Sequences

1. Rooftop Packaged Units

a. Occupied: Energize rooftop units during occupied cycle via manufacturer supplied thermostat. Modulate outside air and return air dampers in sequence and in conjunction with unit's mechanical refrigeration to maintain desired room temperature via manufacturer supplied thermostat.

b. Unoccupied: Maintain outside air damper closed. Cycle unit fan and unit's heating to maintain reduced room temperature of 60 degrees F with unoccupied thermostat.

2. Power Ventilators

a. Energize exhaust fans during occupied cycle and de-energize during unoccupied cycle via electronic time clock control.

PART 4 – CERTIFICATION REQUIREMENTS (CAL Green)

4.1 Factory Air Economizer Certification Procedure

Air economizer acceptance testing is required by the 2013 California Building Energy Efficiency Standards (Title 24 Part 6) Section 120.5(a)4: "Air economizers shall be tested in accordance with NA7.5.4 Air Economizer Controls." The purpose of this test is to assure that economizers work per the intent of the Title 24 standards section 140.4(e) Economizers. The requirements of this acceptance test are described in the Reference Appendices to the Title 24 Building Efficiency Standards Section NA7.5.4 Air Economizer Controls. A detailed description of the test is located in Chapter 10 of the Nonresidential Compliance Manual: NA7.5.4 Air Economizer Controls Acceptance: "At-A-Glance" and "Test Procedure."

Air economizers installed by the HVAC system manufacturer and certified to the CEC as being factory installed, calibrated and tested are exempted from the Air Economizer Controls acceptance test as described in the Nonresidential Standards Reference Appendix NA7.5.4. The following sections describe the requirements of a "factory installed and calibrated economizer" certification and how to apply for California Energy Commission approval of a certification program.

4.2 Factory Air Economizer Certification Requirements

A. Inspection

1. Minimum outside air damper position can be adjusted and outside and return air dampers modulate as necessary to achieve the desired position.
2. Outside air dampers completely close when the unit is off
3. Outside air dampers move freely without binding
4. Provide a 5 year manufacturer warranty of economizer assembly
5. Provide an economizer specification sheet proving capability of at least 60,000 actuations

6. Provide a product specification sheet proving economizer damper sections are certified by AMCA 511 for a maximum damper leakage rate of 10 cfm/sf at 1.0 in. w.g. (Class 1A, 1, and 2 are acceptable)
7. System has return fan speed control, relief dampers, or dedicated exhaust fans to prevent building over pressurization in full economizer model
8. Outdoor air, return air, mixed air, and supply air sensors shall be calibrated within the following accuracies:
 - Drybulb and wetbulb temperatures accurate to $\pm 2^{\circ}\text{F}$ over the range of 40°F to 80°F
 - Enthalpy accurate to ± 3 Btu/lb over the range of 20 Btu/lb to 36 Btu/lb
 - Relative humidity (RH) accurate to $\pm 5\%$ over the range of 20 percent to 80 percent RH
10. Sensor performance curve is provided with economizer instruction material. In addition, the sensor output value measured during sensor calibration is plotted on the performance curve.
11. If the high limit setpoint is fixed dry-bulb or fixed enthalpy + fixed dry-bulb then the control shall have an adjustable setpoint.
12. Sensors used for the high limit control are located to prevent false readings, e.g. properly shielded from direct sunlight
13. High limit shut-off setpoint shall be set to these default limit settings per Table 140.4-B as referenced in Section 140.4(e)3:

END OF SECTION

23 07 13 – DUCTWORK INSULATION

PART 1 GENERAL – Duct insulation shall comply with California Energy and **CAL Green** Codes and Standards.

PART 2 PRODUCTS

2.1 GLASS FIBER, FLEXIBLE

- A. Insulation: ASTM C 553; flexible, noncombustible blanket.
 - 1. **'K' ('Ksi') value : ASTM C 518, 0.045 at 0.31 at 75 degrees F.**
 - 2. **Maximum service temperature: 250 degrees F.**
 - 3. **Maximum moisture absorption: 0.20 percent by volume.**

- B. Vapor Barrier Jacket:
 - 1. **Kraft paper with glass fiber yarn and bonded to aluminized film.**
 - 2. **Moisture vapor transmission: ASTM E 96; 1.3 perm.**
 - 3. **Secure with pressure sensitive tape.**

- C. Vapor Barrier Tape:
 - 1. **Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.**

2.2 GLASS FIBER RIGID BOARD

- A. Insulation: Fiberglass semi-rigid board, 1 inch thick.

- B. Rectangular or Square Duct Insulation: ASTM C 612, Type II.
 - 1. **K-value: 0.23 at 75 degrees F mean temperature.**
 - 2. **All service jacket in compliance with ASTM C 1136, field installed.**
 - 3. **Secure with pressure sensitive tape.**

C. Round Duct Insulation: ASTM C 547, Type I.

1. **K-Value: 0.23 at 75 degrees F mean temperature.**
2. **All service jacket in compliance with ASTM C 1136, factory installed.**
3. **Secure with pressure sensitive tape.**

2.3 EXHAUST HOOD DUCT WRAP

A. Flexible Grease and Air Duct Wrap System; UL listed; foil both sides fully encapsulated.

1. **Meeting requirements of 1 hour enclosure passing UL Classification “Ventilation Duct Assembly - Nos. V-11 and V-12”.**

B. Acceptable Product: Pyroscat Duct Wrap F2E by Vesuvius, Irwin, TN.

C. Other Acceptable Manufacturers: Subject to compliance with requirements herein, products from one of the following manufacturers may be submitted for approval.

1. **ETS Schaefer Corporation.**
2. **Thermal Ceramics.**
3. **Unifrax Corporation.**

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with NAIMA National Insulation Standards.

B. Insulated ductwork conveying air below ambient temperature:

1. **Provide insulation with vapor barrier jackets.**
2. **Finish with tape and vapor barrier jacket.**
3. **Continue insulation through walls, sleeves, hangers, and other duct penetrations.**
4. **Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.**

C. Insulated ductwork conveying air above ambient temperature:

- 1. Provide with or without standard vapor barrier jacket.**
- 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.**

3.2 SCHEDULES

- A. Evaporative Condenser Intake and Exhaust: 1 inch aluminized film.
- B. Outside Air Intake Ducts: 2 inch aluminized film.
- C. Supply Plenums: 1 inch aluminized film.
- D. Supply Ducts: 1 inch aluminized film or 1 inch rigid insulation with service jacket.
- E. Exhaust Hood Duct: Provide installation, clearances, and thickness to meet required fire rating.

END OF SECTION

23 10 00 – MECHANICAL MATERIALS & METHODS

1 PART ONE – GENERAL

1.1 SPECIAL NOTICE

- A. Each Contractor shall read all relevant documents, become familiar with the job, the scope of work type of general construction architectural, structural, mechanical and electrical drawings and the specifications. Each Contractor shall also familiarize himself with the purpose for which these documents have been prepared and shall become cognizant of all the details involved. Each Contractor shall coordinate his work with that of others to the end that unnecessary delays be avoided.
- B. The term “Contractor” used in this section of the specification shall mean the Contractor whose work is covered by this section.
- C. When the term “Engineer” is used in this section of the specification, it shall mean the consulting mechanical engineer.

1.2 FLAME SPREAD PROPERTIES OF MATERIALS

- A. All materials and adhesives used for acoustical linings, jackets and insulation shall comply with requirements of NFPA 90A and 90B and UL guide number 40 V.8.15. Products exceeding a flame spread rating of 25, or a smoke developed rating of 50, as determined by ASTM Test Method E-84 are prohibited. Adhesives and sealers shall be fire retardant and fire resistant when dry. Flame proofing treatments which are subject to decomposition, deterioration, or the effects of moisture are prohibited.

2 PART TWO – PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. All horizontal runs of piping shall be suspended from the structural members above by means of approved hangers spaced as scheduled. Supports and hangers shall be installed to permit free expansion and contraction, the piping shall be guided and firmly anchored. No piping shall be self-supporting nor shall it be supported from the equipment connections or the suspension system furnished for suspended ceilings.

- B. All hangers shall be properly sized to fit the pipe or the insulation

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around the pipe which they are supporting. All hangers shall bear the name of the manufacturer by whom they are made. Pipe hangers shall be formed steel clevis type hanger with adjustable attachment to hanger rod. Hangers shall be properly sized to support weight of piping under operating conditions as recommended in the manufacturers' published literature. For uninsulated copper or brass piping, use hangers as specified above except that they shall be copper plated or plastic sheathed wherever they will be in contact with the copper pipe.

- C. Hangers shall be fastened to the construction by the use of malleable iron adjustable clamps, properly designed and sized for steel encountered and installed with lock nuts or bolts securely tightened. Hangers, rollers, inserts, beam clamps and riser clamps shall be standard products of the same recognized manufacturer.
- D. All miscellaneous steel necessary for supporting the pipe systems from pipe hangers shall be included as part of this section of the work. Necessary trapeze, rods, bolts and accessories, clamps, weld clips, angle iron brackets or other approved means shall be used for attaching supporting steel to the building construction. Where additional steel members are required for hanging the lines in areas with special conditions, the steel work shall be provided as part of this contract.
- E. Each fitting and length of cast iron pipe shall be separately supported by installing the pipe hanger immediately behind the hub. Generally hangers shall be on 5 foot centers, but if 10 foot length of cast iron pipe is used, hangers may be spaced 10 foot on centers.

2.2 FLOOR AND CEILING PLATES

In each finished space, furnish a chromium plated sectional escutcheon on each pipe of hanger rod penetrating a wall, floor or ceiling. Escutcheons shall be sized to fit snugly to all lines and where the lines are insulated, the escutcheons shall be fit snugly over the insulation. Where required, these plates shall be provided with set screws so that they shall fit snugly against the finished surface. Furnish a galvanized or aluminum collar and flange on all ducts passing through floors, walls or ceilings.

2.3 ACCESS DOORS

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- A. Each subcontractor, under the mechanical sections of the work, shall furnish and turn over to the General Contractor for installation access doors as required to operate and service all equipment and valves furnished and installed by him. Access doors shall be of the size indicated on the drawings or required for proper access to equipment with mounting straps, concealed hinges, screwdriver locks and so designed that they will open 180°. The doors shall be constructed from 16 gauge steel with door and frame finished in prime coat finish.
- B. Approved Manufacturers: Milcor, Zurn, Wade, Josam.

2.4 VALVES AND COCKS

- A. Valves and cocks shall be furnished and installed in all branches serving more than one piece of equipment such as pumps, tanks, coils, etc. for shut-off branch mains, eliminating the necessity of interrupting service to the entire building structure for maintenance purposes and where indicated. Valves shall be installed with the best workmanship and appearance and grouping so that all parts are easily accessible. Manufacturer's figure numbers are specified to indicate type and quality and construction and products of approved manufacturers may be substituted for those specified number shown. Valves for similar service shall be of the same manufacturer. Pressure rating specified for valves are steam working pressure regardless of the services for which used except where noted as WWP.
- B. Sizes:
- 2 ½" and Smaller
 - Gate 125# Crane Co. #428
 - Valve BB, Screwed
 - Globe 300# Crane Co. #7
 - Valves BB, Union Bonnet
 - Check 125# Crane Co. #34
 - Valves BB, Screwed
 - PVC Valves to be true union ball valves
- C. Gas Cocks
- ¼ inch to 1 inch inclusive Crane #289

1 ¼ inch to 2 inches inclusive Crane #272

2 ½ inches to 4 inches Crane #324

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- D. Approved Manufacturers: Crane, Homestead, Jenkins, Kennedy, Rockwell, Stockham, Walworth, Nibco, Wolverine and Hammond.

2.5 COMINATION TEMPERATURE AND PRESSURE RELIEF VALVES

- A. Combination temperature and pressure relief valves shall be furnished and installed on all hot water tanks and heaters. Valves shall be constructed and rated in accordance with ASME standards. Valves shall have cast iron bodies, shall be of the diaphragm type, constructed with stainless steel spring. All units shall be field adjustable set to relieve above the operating pressure of the system, but not higher than the design than the design pressure of the tank. Relief connections shall be piped to the nearest floor drain.
- B. Approved Manufacturers: Bell & Gossett, Taco, Thrust, Watts, Spence, McDonnell and Miller.

2.06 UNIONS

- A. Unions shall be installed on each side of each piece of equipment and each automatic control valve in locations that will permit easy removal of equipment or valve for service. Unions shall not be located in concealed spaces. Unions for copper piping systems shall be similar to Walworth Figure No. 3677 and unions for steel piping shall be similar to Walworth Figure No. 771B malleable iron union with bronze to iron seat.
- B. Approved Manufacturers: Crane, Jenkins, Rockwell and Walworth.

2.07 STRAINERS

- A. Strainers shall be of the basket or wye type in sizes as indicated on the drawings and shall be provided with ½ inch valved drain and unless the trainer design is devoid of air pockets, a ¼ inch air vent cock.
- B. All strainers shall have cast iron or bronze bodies of ample strength for the pressure to which they shall be subjected, removable cylindrical or conical screens of nickel, copper or brass and suitable flanges or tappings to connect with the piping they serve. Strainers 2 ½ inches and larger shall be provided with flanged covers.

- C. The free area of each screen shall not be less than three times the area of the strainer inlet and the mesh size shall be suitable for the service intended.
- D. Approved Manufacturers: Armstrong, Cash, Crane, Keckley, McAlear, Mueller, Sarco.

2.8 AIR CHAMBERS

- A. Install one air chamber on each hot water and each cold water pipe to each plumbing fixture or behind each group of plumbing fixtures. Air chambers shall be constructed from copper pipe. If one air chamber is installed on each hot and cold water pipe to each plumbing fixture, it shall be the full size of the supply and 18 inches tall, properly capped; if one is furnished for each group it shall be 2 inch pipe, 24 inches tall. At the subcontractor's option, he may use fabricated chambers with volume at least equal to those herein specified for each type installation.
- B. Approved Manufactures: Nibco, Worverine.

3 PART THREE - EXECUTION

3.1 EQUIPMENT FOUNDATIONS

- A. All concrete equipment foundations and bases required for the installation of mechanical work hereinafter specified will be furnished and installed by the General Contractor. Each subcontractor shall be responsible for the proper coordination of his equipment with these bases. He shall furnish all anchor bolts and other accessories required for casting bases and setting of all sleeves and/or anchor bolts.
- B. After equipment is set on concrete bases, the equipment shall be fully grouted to the base filling all void spaces with a non-shrinking grout.
- C. All roof top equipment shall be properly bolted or fastened to the structural steel framework to prevent movement under high wind and adverse weather conditions.
- D. Curbs shall be installed around the perimeter of roof top equipment.

3.2 EXCAVATION AND BACKFILL

- A. All necessary excavation and backfill for the installation of the

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mechanical work shall be accomplished by each subcontractor under his phase of the work. All such work shall be included regardless of the type of materials encountered in the excavation. All excavation on this project shall be performed in accordance with applicable sections of Division 2 of the specifications or this article of the specification, whichever is the most stringent.

- B. Trenches for all underground piping shall be excavated to the required depths. The bottoms of the trenches shall be tamped hard and graded to secure maximum fall. Bell holes shall be excavated to assure the pipes resting for its entire length on solid ground. Should rock be encountered, it shall be excavated to a depth of 6 inches below the bottom of the pipe and before laying the pipe, the space between the bottom of the pipe and rock surface shall be filled with gravel and thoroughly tamped. Pipe laid in trenches dug in fill shall be supported down to load bearing undisturbed soil. After the pipes have been tested, inspected and approved by the Engineer and the local inspection authorities, the trenches shall be backfilled with clean dirt as follows:
- C. Backfill shall be installed in layers 12 inches deep, adequately tamped and wetted down or flushed before the second layer of earth is laid in place. This process shall be continued until the trenches are filled. No roots, rocks or foreign material of any description shall be used for backfill by this subcontractor and any excess materials and debris shall be removed from the site by this subcontractor. Any special backfill material shall be provided as hereinafter specified and as shown on the drawings.
- D. All excavating and backfilling shall be done in a manner so as not to disturb adjacent structure and any shoring required shall be furnished.

3.3 OPENING AND RECLOSING OF CONCRETE FLOORS AND WALKS

- A. Where excavation requires the opening of existing concrete floors, walks, or other paved areas, the pavement shall be cut as required to install new lines and make connections to existing lines. The size of the cut shall be held to a minimum consistent with the work to be accomplished. After the installation of the new work is completed, the excavation shall be properly backfilled to the level required for the

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replacement of paving. All concrete work for the finishing of these openings will be performed by the General Contractor.

3.4 SCAFFOLDING, RIGGING AND HOISTING

- A. Each Contractor shall furnish all scaffolding as required for the installation of his work. He shall either arrange with the General Contractor for servicing in connection with any rigging and hoisting required to provide his own equipment to hoist apparatus to be installed by him into place. Each Contractor shall see that any equipment too large to permit passage through normal doorways and access ways is brought to the job and set in place before the mechanical spaces are enclosed. All apparatus not delivered in this manner shall be disassembled and reassembled in the proper location. Equipment specified to be factory assembled and tested prior to shipment not be disassembled for shipment in an installation into the building.

3.5 JOINING OF PIPING SYSTEMS

- A. Cast iron piping systems shall be joined with lead and oakum, pre-formed neoprene joints or no-hub connectors at the subcontractor's option, as allowed by code. If caulked joints are used, spigots shall be placed in the bell and properly centered and lined in piping before packing starts. Joints shall then be properly packed with dry oakum and then caulked with not less than one pound of lead for each one inch pipe diameter. Lead shall be poured and caulked in layers and then faced flush with hub. Piping shall be carefully handled after joint is made to insure that jointing and material are not damaged.
- B. Copper piping systems shall be joined with solder joints except that water distribution systems buried below buildings slabs shall be joined with compression type fittings. For solder type joints, the tubing shall be cut smooth and square and all burrs removed with a reamer and when necessary, tubing shall be rounded out with a sizing tool. All surfaces shall be properly cleaned by polishing both cup of fitting and the tube end with steel wool or fine sand cloth. After cleaning, flux shall be applied evenly to male end of tubing and shall be inserted into the fitting, revolving the fitting once or twice on the tubing end to spread the flux evenly. After inserting tubing in cup of fitting, apply flame to outside of cup only. Do not apply solder with brush and wipe

clean. Solder shall be recommended by the manufacturer for the pressures involved, but shall generally be 95 – 5 hard solder. Refrigerant piping shall be joined as hereinafter specified for that particular application.

- C. Threaded and coupled piping systems shall be joined with properly lubricated screwed joints. Pipe shall be cut smooth and square and all burrs shall be removed with a reamer. Tapered threads shall be properly cut on the male end of the pipe and shall be a sufficient number so that when the pipe is pulled up tight in the coupling, at least three full threads remain exposed. Joints shall be made tight with graphite and oil applied to the pipe threads only and not to the fittings. No pipe thread caulking compound shall be used. Where chromium plated piping and fittings are involved, they shall be made tight using strap wrench. Completed chromium plated piping shall not show any wrench marks on piping and fittings. All piping so marred shall be removed and replaced before acceptance of the job. On galvanized piping systems after the piping has been fully assembled and tested, all exposed threads shall be painted with a heavy coat of red lead or other rust inhibitor paint.
- D. All mechanical, no-hub and no-ring type sockets shall be installed in full accordance with manufacturer's published directions, whose instructions shall be submitted to the Engineer for approval before proceeding with the installation. Engineer's approval of this data will not absolve the subcontractor from any guarantees and required tests.
- E. Plastic piping systems, PVC, polyethylene, ABS, or polypropylene shall be joined by the use of socket type plastic fittings of the same material with either solvent cement and/or heat of fusion type joints. All piping shall be cut smooth and square, all burrs removed, and all surfaces properly cleaned. Solvent cement shall be of the type as recommended by the pipe manufacturer and all procedures shall be in accordance with manufacturer's published directions. Pipe shall be used on PVC fittings.

3.6 VIBRATION ISOLATION

- A. Transmission of vibration or structural borne noise to occupied areas by equipment installed by the Contractor will not be permitted. Contractor shall furnish for approval, data showing disturbing frequency, supported weight, static deflection, efficiency and calculations supporting same for each isolator he proposes to use. Equipment shall be manufactured by Amber-Booth, Korfund, Mason

SECTION 15100 – MECHANICAL MATERIALS & METHODS

Industries, Vibration Eliminator, Vibration Mounting, or Consolidated Kinetic Corporation.

- B. All isolators shall be selected and certified, using published data, to limit vibration transmission to 10% for equipment located on floors in direct contact with grade, add 5% for equipment located other than the above. Should any noise or vibrations be objectionable to the Engineer and/or Owner, field instrumentation test and measurements shall be made by the isolator manufacturer or his representative to determine the source and cause of such disturbance. Any non-compliance with these specifications shall be corrected by the contractor in a manner satisfactory to the Engineer at no additional cost to the Architect, Engineer or Owner.

*****END OF SECTION*****

23 31 00 – DUCTWORK

PART 1 GENERAL – Not Used

PART 2 PRODUCTS

2.1 MATERIALS

- A. Galvanized Steel Ducts: ASTM A 525 and ASTM A 527 galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A 90.
- B. Insulated Flexible Ducts:
 - 1. **Two ply vinyl film supported by helically wound spring steel wire; fiberglass insulation; aluminized vapor barrier film.**
 - 2. **Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.**
 - 3. **Maximum Velocity: 4000 fpm.**
 - 4. **Temperature Range:-10 degrees F to 160 degrees F.**
 - 5. **Acceptable Products:**
 - a. Thermaflex Model M-KE.
 - b. Flexmaster.
- C. Fasteners: Rivets, bolts, or sheet metal screws.
- D. Sealant:
 - 1. **Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.**
- E. Hanger Rod: ASTM A 36; galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide[air foil] turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.
- C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- D. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

2.3 MANUFACTURED DUCTWORK AND FITTINGS

- A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- C. Duct Sizes are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- D. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

- E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- F. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.
- G. Use double nuts and lock washers on threaded rod supports.
- H. Connect terminal units to supply ducts [directly or] with one foot maximum length of flexible duct. Do not use flexible duct to change direction.
- I. Connect flexible ducts to metal ducts with draw bands.
- J. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for clean out. Use stainless steel for ductwork exposed to view and stainless steel or carbon steel for ducts where concealed.
- K. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

3.2 CLEANING

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.3 NA

3.4 NA

3.5 NA

3.6 NA

3.7 NA

3.8 SCHEDULES

- A. DUCTWORK MATERIAL SCHEDULE

AIR SYSTEM	MATERIAL
Low Pressure Supply	Galvanized Steel

AIR SYSTEM	MATERIAL
Return and Relief	Galvanized Steel
General Exhaust	Galvanized Steel
Kitchen Hood Exhaust	Galvanized Steel
Dishwasher Exhaust	Stainless Steel
Outside Air Intake	Galvanized Steel
Combustion Air	Galvanized Steel

END OF SECTION

23 33 00 – DUCT ACCESSORIES

PART 1 GENERAL – not used**PART 2 PRODUCTS****2.1 AIR TURNING DEVICES/EXTRACTORS**

- A. Multi-blade device with radius blades attached to pivoting frame and bracket, galvanized steel construction, with push-pull operator strap.

2.2 BACKDRAFT DAMPERS

- A. Gravity Backdraft Dampers, Size 18 by 18 inches or smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturers standard construction.
- B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: 16 gage thick galvanized steel, with blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover.
 - 1. **Less Than 12 Inches Square: Secure with sash locks.**
 - 2. **Up to 18 Inches Square: Provide two hinges and two sash locks.**
 - 3. **Up to 24 by 48 Inches: Three hinges and two compression latches [with outside and inside handles].**
 - 4. **Larger Sizes: Provide an additional hinge.**
- C. Access doors with sheet metal screw fasteners are not acceptable.

2.4 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- B. Connector: Fabric crimped into metal edging strip.
 - 1. **Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.**
 - 2. **Net Fabric Width: Approximately 2 inches wide.**
 - 3. **Metal: 3 inches wide, 24 gage galvanized steel.**

2.5 VOLUME CONTROL DAMPERS.

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.
- B. Splitter Dampers:
 - 1. **Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.**
 - 2. **Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous hinge or rod.**
 - 3. **Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.**
- C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch. 12 by 48 inch.
- D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- E. End Bearings: Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
- F. Quadrants:
 - 1. **Provide locking, indicating quadrant regulators on single and multi-blade dampers.**

- 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.**
- 3. Where rod lengths exceed 30 inches provide regulator at both ends.**

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 15810 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ductwork in accordance with NFPA 96. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.
- D. Demonstrate re-setting of fire dampers to Owner's representative.
- E. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.
- F. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- G. Use splitter dampers only where indicated.
- H. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

23 37 00 – AIR OUTLETS & INLETS
--

PART 1 GENERAL

1.1 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

PART 2 PRODUCTS

2.1 MANUFACTURERS:

- A. Acceptable Manufacturers:
 - 1. **Titus.**
 - 2. **Krueger.**
 - 3. **Metalaire.**
- B. Substitutions: Submit in accordance with Section 01 60 00.

2.2 ROUND CEILING DIFFUSERS

- A. Type: Round, stamped or spun, multi-core diffuser to discharge air in 360 degree pattern, with sectorizing baffles where indicated. Diffuser collar shall project not more than one inch above ceiling. Core shall be adjustable for vertical or horizontal throw.
- B. Fabrication: Steel with baked enamel off-white finish.
- C. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.
- D. Acceptable Product: Refer to schedule on Drawings.

2.3 RECTANGULAR CEILING DIFFUSERS

- A. Type: Square, stamped, multi-core diffuser to discharge air in 360 degree pattern with sectorizing baffles where indicated.
- B. Frame: Inverted T-bar type.
- C. Fabrication: Aluminum with baked enamel off-white finish.
- D. Accessories: Opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.
- E. Acceptable Products: Refer to schedule on Drawings.

PART 3 EXECUTION**3.1 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 91 00.

END OF SECTION

25 51 00 – OBSERVATORY AUTOMATION SYSTEM

Coordinate city purchased technology/ instruments, and add technical information for complete automation. The General Contractor shall provide all data, shop drawings, engineering, specifications, and product information for complete system to be reviewed by owner and architect. The following sample automation specifications shall be used as a guide only and does not necessarily include all aspects of the required system.

Purchase and install a Digital Dome Works Model 4 Observatory Automation System.

**Contact: TECHNICAL INNOVATIONS
7851 Cessna Ave.
Gaithersburg, MD 20879 USA
(301) 977- 9000**

Digital Dome Works

MODEL 4

Version 5.1, DDWCP

It is essential that the General Contractor and Owner read these instructions because the assembly involves the careful placement of components, the need to perform mechanical and electrical assembly, and some electronic testing. Follow the installation and testing steps in the order presented. Installers will be more successful if quite methodical about it, rather than inventing own approach! Also, be sure to use the installation manual that comes with the DDW equipment. Check the dates to assure using the most up-to-date version. Note that this revision of the DDW Instruction Manual may be more current (later date) than the Help Screens in the software. For conflicting information, use this Manual as the guide. Note App.9 gives list of instruction manual changes by date.

CAUTION

Technical Innovations, Inc. is not responsible and assumes no liability for any damage or injury arising from assembly or use of this product. While the instructions include cautions and warnings, it is ultimately the customer who must exercise good judgment and care during assembly and operation to avoid damage to materials or persons, and it is the customer who assumes all risk and liability. Under no circumstances will Technical Innovations, Inc. be responsible for consequential damages to person or property.

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DDW5.1INS

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Welcome to the World of Remote Observing

This Welcome is a brief story of a typical observing session with Digital Dome Works. Although we assume an observing session using the Home-Dome, it could just as easily be a fifteen foot Pro-Dome. While your installation and circumstances may not match our assumptions, there will be enough similarity to help you understand the capabilities and limitations of the system.

We will assume the following equipment has been set up for remote control astronomy:

- Home-Dome HD6S, using the Digital Dome Works Control Program (DDWCP)
- 10 inch Meade LX200 Telescope using TheSky® V.6 control software
- ST-2000XM CCD camera by SBIG, using CCDSoft V.5 software for camera control
- RoboFocus remote focusing system
- Windows XP and Remote Desktop

The Home-Dome is 150 feet from the observer's control room. There is a PC-called the In-Dome Computer-inside the observatory that runs the dome, scope, and CCD software. This PC communicates to the User Computer using a local network connection. The computers and software are all running Windows XP Pro. The scope and Home-Dome have already been aligned, and the system has been used recently. The user controls and communicates with the In-dome Computer using Windows Remote Desktop (software that allows the user to simulate being in the dome at the keyboard of the In-dome Computer).

Some terminology may be unfamiliar to you. We attempt to use these words in context to give you a better understanding the remainder of this manual. Enjoy!

The Story

It is early twilight, and Saturn is high in the west. Everyone has gone to bed, except for Christian, (who wants to try taking a CCD image of the planet), and his older brother Jeremy. Jeremy is the lead person tonight.

Jeremy turns on the control room computer, and selects the Windows Remote Desktop icon. In a few seconds, Jeremy's computer screen displays the Remote Desktop logon dialog box. Once the correct password as been entered, the In-dome Computer screen appears with icons, just as if he was sitting there.

Using his mouse, Jeremy clicks on the DDW icon. This starts the Digital Dome Works Control Program (DDWCP) on the In-dome computer. DDWCP then connects to the DDW processor in the Home-Dome. In a few seconds, DDW responds — the In-dome computer has established connection with DDW.

Jeremy's screen then shows the resulting data on the main DDWCP control screen. This shows that the shutter is closed (as it should be), and that the dome is in the Home position (also as it should be).

Although Jeremy could look out the window to see the weather, he decides to check the (Optional) weather system information located on the DDWCP window. The weather information shows that the wind is only about 6mph, temperature is 65°F, and that it is apparently raining, i.e., the rain sensor shows activity. Jeremy, of course, knows that there has been no rain. He decides that the birds have again done their thing, but that the wetness measurement interlock has prevented the dome from opening. He is ready to over-ride the sensor to open the dome, but Christian reminds him that the wetness may be the result of the water falling on the dome from the lawn sprinkler. Christian turns off the water, and Jeremy decides it is safe to override the still wet sensor and open the dome.

Comment: This illustrates several important issues. The user has the ability to detect a variety of conditions that may affect operation. The rain sensor was doing the right thing: the system will protect itself (i.e., the contents of the observatory). The lawn sprinkler is a good example of a remote problem. Unexpected events will occur, and we need to be cautious in over riding protective interlocks. It is vital that a truly defective interlock be repaired as soon as possible, so that mistakes will not occur. Jeremy's decision to over-ride the sensor was valid (though he was a bit quick to do so!).

Jeremy now clicks on "OPEN" button. The screen shows that the dome shutter begins to open, and about 30 seconds later, that the shutter is full open.

Jeremy will be slaving the dome to the telescope, so he clicks on the "Slave" button. DDWCP will now obtain the scope direction from TheSky software, and change the dome position to match.

Comment: TheSky and several other scope control programs will not only direct the scope around the sky, but will write this direction to a file in the In-dome Computer. DDWCP reads that file every few seconds to find out where the telescope is pointed. DDWCP carries out several calculations to find the proper dome direction, and then commands DDW to move the dome accordingly. An alternative slaving scheme (good for an LX200 only) is available. If DDW is connected directly to the scope, it can interrogate the scope and get its direction immediately, and then use this data to control the dome. This is particularly useful if the scope control program does not support the data file or similar method of operation.

With the dome slave function turned on, Jeremy is ready to turn on the telescope. But first, he remembers that the CCD camera is not running, and that it takes a while to cool down and be ready for operation. Jeremy has installed an optional remote power module that allows him to turn items on or off in the dome by remote control. He selects the User Pin button he has named "CCD Camera" on DDWCP, and turns on Channel 1

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which is connected to the relay, which turns on the 120VAC power supply for the CCD camera.

Next he uses his mouse to click on TheSky icon, which opens a copy of TheSky on the In-dome computer. After a few seconds, TheSky planetarium screen shows on Jeremy's screen. He uses the menu to find Saturn, and selecting it, he centers Saturn on his screen in a red circle.

Now to run the telescope! He uses the menu to select Telescope/Connect. After a few seconds, TheSky screen shifts direction, showing a white circle on some stars, indicating that the telescope is connected, and is pointed there.

Jeremy again selects and centers Saturn in the red circle. He clicks on Saturn, which brings up a small data and menu box. He selects "Slew To", and the telescope begins moving to aim at Saturn. A small screen shows that the telescope is slewing, and after about 20 seconds, the white circle creeps over Saturn.

Comment. Note that Jeremy did things in the "wrong" order — he should have turned on the telescope, then selected Saturn. This illustrates the desirability of planning your observation to save time and irritation. More importantly, you will want to plan a sequence of observations to minimize time wasted slewing back and forth. You may also need to plan the sequence so that the telescope and CCD cables do not become tangled, or to avoid the telescope taking the "long way around" to get to an object. If you are nearby (as Jeremy is), fixing mistakes is usually easy. If you are 100 miles away, the solutions are more difficult!

Meanwhile, as the scope was turning, so was the dome. Jeremy could see this on the DDWCP screen, which is updated as the dome turned.

Jeremy now has the scope and dome aimed at Saturn. He is ready to operate the CCD camera. He clicks on the CCDSOFT icon, which after a few seconds shows the CCDSOFT control window. He uses the menus to connect to the camera, and position the correct filter. Christian promptly says "you did it again, Jeremy. When you connected to the CCD camera, you forgot to enable the camera cooling. If you had, the camera would be ready now!" Jeremy groans, but turns on the camera cooling, aware that it will be five minutes before the camera is cold. "I was just testing you," he grins, glad that Christian is paying close attention.

Even though the camera is not cool, it can still be used. Jeremy selects the exposure to use, and takes an image. In a few seconds, the magic of Windows Remote Desktop brings an image onto his screen. Saturn is not there! But wait, it looks to be just off the CCD, a little to one side. Jeremy selects the telescope motion controls in TheSky, and moves the scope slightly, then takes a new picture. After several tries, there is Saturn, almost at the center of the image.

Comment: CCD cameras are incredible, but the camera-telescope combination is not a "point and click" operation. The field of view is small, and skill and practice are necessary to get good results. The sky will still be there tomorrow and next year: astronomy requires and rewards patience.

With Saturn centered, Jeremy asks Christian why he thought the camera did not show it right away. He suggests that maybe the scope is not set up right. Jeremy, who had just finally read the entire instruction manual, points out that the scope pointing accuracy is close, but that its software allows you constantly to refine its pointing. So, using the telescope controls on TheSky menu, he "synchronizes" the scope to Saturn.

Jeremy suggests that Christian now try to get a good picture of Saturn. Christian takes over. He makes a short exposure of Saturn but, finds it is very fuzzy, obviously out of focus. Christian starts the RoboFocus Control Program and begins nudging the focus (remotely on the telescope) to improve the image. After each focus adjustment, he takes a new image to see the result. After five minutes, he is growing impatient; but finally the image begins getting better, and converges to a focused image. His determination pays off.

Comment: Again, remote control is not point and click focusing by remote control requires the right equipment and some fore-thought. Usually, focus will stay accurate from one night to the next. In this case, Jeremy has been into the dome, and had switched to a different set of lenses. Using RoboFocus, Jeremy can simply dial in the correct focus setting for the new setup, then refine it easily by focusing on a star (much easier than a planet!). He can even do it automatically using RoboFocus!.

Jeremy now helps Christian close the dome. He uses the DDW User Pins control to activate a remote TV monitor inside the dome, so that they can see what is happening. He starts the video capture in the In-Dome computer, and views its output via Windows Remote Desktop. He closes TheSky, thus terminating the PC connection to the telescope. He goes to the DDW screen, and selects CLOSE. DDW directs the dome to turn to the HOME position, and then closes the shutter (which they watch on a video monitor). He shows Christian how to transfer his image files from the In-Dome computer to the control room PC and print them. Satisfied with their work, they go to the kitchen for ice cream.

Comment. When he closed TheSky, Jeremy did not first terminate the connection to the scope. Although in this case, such a practice caused no problem, it is far safer to turn off programs in the reverse order than was started. Jeremy did use his available video monitor to observe the closing of the dome. Although not necessary, this is good practice: one should use all the available information to understand what is going on in a remotely operated facility. But his worst mistake was that he never turned off the drive (or the power) to the LX200 scope. As a result, the scope would continue to track Saturn (its last target) until the wires are wrapped tightly around the scope, and something breaks. In this case, DDW saved him! Whenever the dome closes, if the

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DDW is connected to the LX200 it will send a series of commands to the LX200 that will stop the drive (unless the feature is turned off). Thus, when Jeremy turns on the observatory again, the scope will be parked, and ready for the next session!

Welcome aboard a new observing experience!

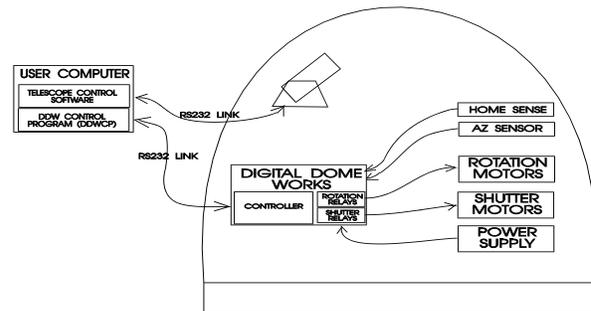
Glossary

ADC	Analog to Digital Converter. Device used to measure an analog voltage and give a digital reading. E.g. 8-bit (256 values) ADC
AZ	Azimuth. Measure of direction or angle in the horizontal plane. North is zero, and azimuth increases to 360 deg. clockwise. Note: LX200 telescopes measure AZ CW from South.
CCD	Charge Coupled Device-digital camera used in astronomy
CW/CCW	Clockwise/Counterclockwise
Comm Port	Serial port on PC, usually a 9-pin male connector on PC
DDW	Digital Dome Works. DDW may mean the whole system, or the controller itself (esp the main chip).
DDWCP	DDW Control Program. Program provided with DDW that runs in a PC and allows user to control DDW hardware and software remotely.
DSR	Dome Support Ring-a part of many Home-Dome/Pro-Dome observatories
DIP (switch)	Dual Inline Pin. A DIP switch is a small device containing 4-8 switches used to set configurations.
DomeTop	Dome Top. Refers to the top, rotating portion of observatory.
DomeWall	Dome Wall. Refers to the wall, non-rotating section of the observatory.
Firmware	The program in the main DDW processor is called firmware because it is loaded once into the processor as a permanent program.
I/L	Interlock. A sensor that registers a particular condition and that is used to prevent some activity. E.g., a wind speed interlock that prevents operation of the observatory.
InDome PC	Computer in or very close to the PC that has direct wires to control the various observatory instruments
LED	Light Emitting Diode. Small light emitting devices used as indicators for power, interlock status
MODEM	Part of computer that transmits digital data over the telephone lines.
PIC	Programmable Interface Controller. This is a small microprocessor with a permanent stored program that controls peripheral devices. Synonymous with CPU.
RS232	A particular convention for the voltages and timing for serial communication. RS232 uses +12v for a logic zero, and -12v for a logic one. Non-RS232 serial communication between digital devices use +5 for logic zero and 0v for logic one; however, the timing of the data pulses is the same.
Serial	Serial data is the term for digital data that occurs on one wire, with pulses in a sequence representing the data. Data are sent at a particular Baud Rate, usually 9600/sec, which is about 1000 char/sec
Signal/Power	"Power" wires are those that carry electrical energy for the operation of a component such as a motor or Control Unit. These usually have relatively large conductors to reduce voltage drop. "Signal" wires or cables are used to transmit varying voltages that carry information, as in a sensor output. All signal wires in this installation are 6-conductor cables.
TheSky	Program from Software Bisque Co. that represents the sky, and provides for telescope control. V5 provides interface data suitable for DDW
User PC	PC at the user location, connected to the In-Dome PC via network, modem, or other means
UPS	Uninterruptible Power Supply. This is a battery powered 120VAC power supply that takes over when the power line is down. The UPS will power the in-dome computer and DDW (and dome motors) for about 15 minutes.

CH 1. DDW Description

Digital Dome Works (DDW) is a tool for controlling an observatory from a nearby or long distance location. It has the following features:

- DDW can remotely operate the observatory shutter.
- DDW can remotely operate dome rotation motors, and can match the dome position to the telescope position.
- DDW provides output data to the operator, including status information on the shutter and the current dome azimuth.
- DDW can control the dome with its own software if you are using a telescope control program that is not designed to communicate with DDW.
- If the telescope is an LX200, DDW can read the scope azimuth from the scope and synchronize the dome rotation.
- Communication between the control software and DDW is via a dedicated digital serial line or RS232 connection.
- The optional Remote Power Module provides software control of 4 electrical circuits (“User Pins”).
- You can operate most DDW functions via the hand control, and can even slave the dome to the scope WITHOUT using a computer connection
- Although DDW is designed for a dome observatory, it will also control roll-offs and similar motorized facilities.



DIGITAL DOME WORKS

DDW1

WARNING: The DDW is designed for remote operation by persons familiar with the system. The system controls machinery which can damage itself, other equipment, or even injure persons. Any person using DDW, or working in or using an observatory to which it has been fitted, must receive proper training in its use. Safety for persons and equipment must be a part of any observing program.

Terminology

You will want to be familiar with the following terms used in these instructions:

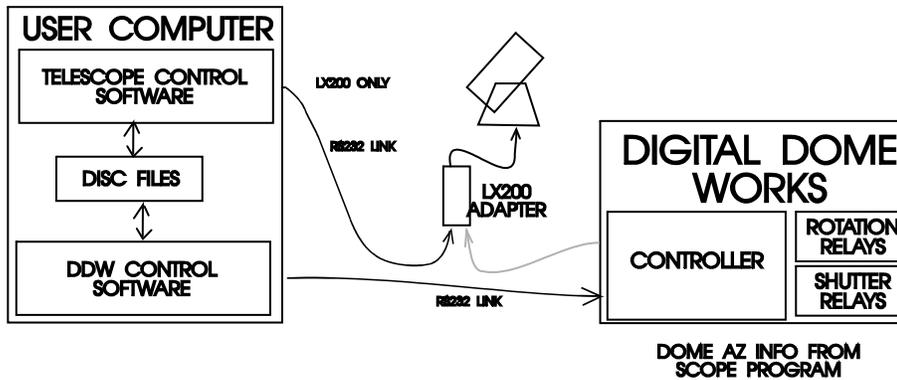
- **DDW.** The physical Digital Dome Works unit in the observatory, including its internal firmware
- **DDWCP.** The standard DDW Control Program that runs on the user computer. DDWCP sends commands to the DDW, which then executes the commands.
- **Custom Software.** Software designed by the user which substitutes for DDWCP (for example, DDW commands might be built into a custom telescope control program).
- **Remote Operation.** Controlling the dome with DDW from a control room rather than inside the dome
- **Local Operation.** Controlling the dome with DDW hand controls while inside the dome.
- **Nearby Remote.** Controlling the DDW using a computer either in the dome or within about 400 ft. or less from the observatory
- **Long Distance Remote.** Controlling the DDW using a computer from more than 400 ft., or even many miles distant from the observatory
- **Manual Remote.** The human sending azimuth and shutter control commands to the dome from the DDW software (In contrast to Slave mode).
- **Standard Control.** Software The DDWCP software for remote operation
- **Slave Mode.** The dome azimuth position will automatically track the telescope position.
- **Sensor.** A device in the dome that provides feedback to the operator. DDW hardware includes two sensors for the shutter position (open and closed) and one for the dome rotation.

- **Interlock.** A device in the dome that has the power to prevent some action from occurring if a dangerous situation is present. For example, the DSR interlock will prevent the dome from rotating if the Dome Support Ring is open.
- **Home Position.** The position of the dome in which the shutter motor may be opened or closed (shutter operation not possible except at Home). DDW detects the Home position sensing when it connected to the shutter motor contacts (even if the shutter motor is not being operated).
- **Dome Azimuth.** The position of the Dome relative to North (increases clockwise CW). (Note that Meade LX200 azimuth readout starts in the South)
- **Power Cable.** Cable used to transmit substantial power, as in the wires that supply the rotation motors
- **Signal Cable.** Cable used to transmit signals at very low power, as in the wires connecting the DDW and the computer.

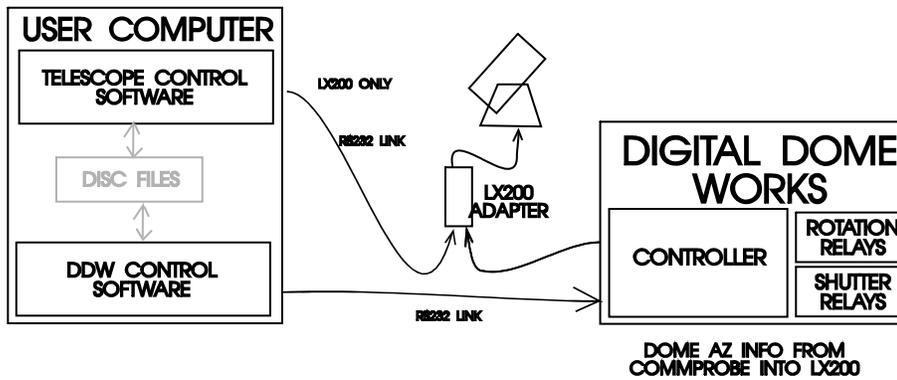
System Architecture

DDW can function in a variety of hardware and/or software configurations depending on the needs of the user and the software programs that are available for telescope control. A key question in deciding the configuration is whether the telescope and dome will be run from the same software, or from separate programs.

The most typical setup has the DDW Control Program or DDWCP (which we provide) running in the user computer, along with other software desired by the user which will



DISC FILE DATA TRANSFER



SCOPE INTERROGATION

DDW SLAVE CONTROL METHODS

□City of Rancho Mirage City Project No. CP15-315 Rancho Mirage Observatory□
provide telescope and CCD control: This would be a Local (nearby) Remote operation. The DDWCP provides the display and control functions needed by the user. Note that this is in addition to the fixed internal program run by the DDW processor within the DDW control unit in the observatory.

The operating problem is to get the telescope pointing information into the DDWCP so that it can send the proper commands to the DDW processor to move the dome. There is a variety of solutions:

- Some commercial telescope control software provides for internal PC communication of the telescope position to DDWCP. Note: this “communication” may be accomplished by having the telescope software (e.g., TheSky6) write the desired azimuth or RA/DEC to a file, which the DDWCP then reads. Or the dome may be controlled via DDWCP by ASCOM commands issued by the scope control software.
- DDW can use Robert Denny’s Astronomer’s Control Panel (see <http://acp.dc3.com>) to retrieve the RA/DEC from the telescope. A fully functional demonstration version is included on our software CD. The included program is a demo version, but includes telescope control (all those available in the LX200 including the stored planets and object positions), scripting, and voice control. After 20 uses, the features other than telescope control turn off (unless you choose to purchase the full program). However, the scope control features remain operable and are very useful.
- If an LX200 is used, the DDW processor in the dome can extract the telescope azimuth directly from the scope using our LX200 Adapter. The DDW can then align the dome to the telescope. The dome azimuth will be displayed on the DDWCP screen, but not on the telescope control software.
- Manual remote direction of the dome azimuth by entering the desired azimuth in the DDWCP.

System Needs-Local Remote

In general, a DDW installation requires a user computer that can run under Windows 2000/ME/XP or Windows Vista. This computer will control the telescope, CCD, and DDW system.

Communication needs include the communications cabling to the telescope and CCD. Most often, the telescope will be run by its own RS232 connection, while the CCD may be either USB, RS232 or a printer cable connection (you can run a high quality printer cable up to 100 ft. or more without buffering. Longer runs may require buffering amplifiers or an alternative control system (see below)). The DDW will require its own RS232 line.

For runs up to several hundred feet, you can use twisted pairs (CAT5 network cable) for the RS232 connection. Runs of more than this length usually require special interfaces. We have had success with RS232 cable runs over 300 feet using CAT5 cable.

Thus, there may be a need for as many as three (3) RS232 COM ports on your computer, with two or three cables going to the observatory. Most computers have only two available, external COM ports, often with one being used for the mouse (the keyboard and modem use internal ports). Thus, there is often only one free RS232 port for the user. Thus, if either two or three are needed, you will need to have your computer supplier provide a special card to add at least one additional COM port. The cost for this ranges from about \$75 to 150 or more. The card may require that interrupt settings be changed in your machine, which can be done by a qualified technician. USB to serial adapters and hubs also work well. There is further discussion of this issue in the Appendix.

DDW, of course, requires that the dome shutter and rotation can be controlled electrically, (non-TI observatories can be controlled with custom interfaces). 120VAC must be available in the observatory (240VAC on special order).

System Needs-Long Distance Remote

If the distance from the user computer to the observatory is large, the cost of multiple cables may be high. Furthermore, distances over several hundred feet are impossible to service without very expensive two-way repeater amplifiers or other techniques. An alternative system architecture that will handle these situations is to have the user operate a “User computer” communicating to a second “In-Dome computer” in (or very near) the observatory.

You can do this by using remote software (such as PCAnywhere® or Remote Desktop) that allows the user computer to operate the In-Dome Computer as though the user was in the dome. The two computers may be linked using a simple serial line, or by a LAN (Local Area Network), or via a telephone line or Internet.

In this system, the In-Dome Computer contains and is running the various operating programs (telescope control, CCD control, and DDW Control Program), while the user computer screen shows the same as the Dome Computer, and the User’s keyboard operates as though he/she were in the dome. PCAnywhere and similar software is available from computer dealers or from us. Note that this architecture will support any standard programs in the dome computer (so long as they will run under Windows XP and Vista): special or custom programs are not required. Furthermore, only one set of programs (in the dome computer) are required (though each user computer will require a copy of PCAnywhere).

When the distance to the dome is in the several hundred-foot range, while too long for multiple cables is short enough to run at least a simple direct network connection. Using a LAN (with a simple cable) is appealing because network cards are inexpensive, cabling is cheap, the operation is fast, and Windows offers relatively good support for it. This option is discussed later on in this manual, and you may call us for more information.

For Internet applications, you may use either the PCAnywhere approach (using standard programs) described above, Windows Remote Desktop, or by use of a special integrated program that will run on the user computer. This integrated program can send and receive commands and data to the In-Dome computer running a special matching program. This program, in turn, operates the observatory components (scope and CCD). Software Bisque produces such a program set that can be used with TheSky6 for this purpose. We can supply a program (the Serial Redirector) that will allow DDW also to operate in parallel with TheSky6 in this application. The downside of this approach, relative to using PCAnywhere, is that you must use matching software and cannot mix and match programs. The upside is that it may offer somewhat faster screen updates for the user.

If you are planning to use Very Long Distance operation, (many miles), you may need, or want additional features in the system. These include remote weather indication and interlocks, Uninterruptible power supply (UPS), and remote TV monitoring of observatory interior. These components are available through us: please call for details.

These options are described further in the Appendices.

CH 2. Installation of Digital Dome Works

Introduction

These instructions are written for installation of DDW on a HOME-DOME or PRO-DOME observatory. We assume the electric shutter and rotation are installed in the dome and functioning well. If you have an observatory made by another company, you may need custom interfaces so that DDW can control their motors. Under no circumstances should you modify DDW to control 120V motors directly. Contact us for details and advice.

We also assume that you will read the “Operating Instructions” portion of this manual to gain an overview of how DDW functions. Being prepared with this information will make the installation go more smoothly.

A hint: we recommend that you lay out all the parts and their connecting wires to assure that your chosen locations can be connected using the wiring supplied: Finding that a wire is 3 inches too short is very frustrating! We urge that you read App. 2 which gives hints on handling small wires.

DDW installation requires:

- install the rotation azimuth sensor (rotating wheel assembly)
- install DDW processor unit (steel box on dome wall)
- install end of motion shutter sensors and Shutter Relay Box
- install one capacitor on each drive motor (older motors only – check with us)
- install Entry Switch (optional)
- connect power, signal, and interlock cables (provided)
- install DDW Control Program in user computer
- test the system.
- install Optional Devices

Installation should take 4 hours or so, and will require some drilling and cutting.

Azimuth Sensor

The azimuth sensor is a rotating wheel optical encoder that registers motion of the dome at approximately one-inch intervals (in some cases, this can be interpolated to 1/4”). You will mount it on the underside of the base ring top flange at a convenient location. In the past, our “standard” location is at the right rear of the dome wall near the shutter contacts; however, our domes built after March 2001 include a spare precut hole for this purpose (same as a support roller hole) on the right hand side of the base ring. We provide a 12 foot cable for connecting the azimuth sensor to the DDW.

To install, you will need access to the top flange of the base ring. Rotate the dome so that the DSR Swingout (or splice plate) is at the location desired. Open the Swingout to give access to the flange. **WARNING:** do not rotate the dome while the DSR/Splice Plate is open. Hold the sensor under the top flange to determine an approximate location convenient for bolting the sensor in place.

If not precut, cut out a hole of about 1 in. x 3 in. in the flange for the sensing wheel. You can drill starting holes and use a saber saw or file. When the hole is ready, hold the sensor in the mounting position with the connection jack facing IN, and mark the mounting holes. Drill 9/32 holes and install the sensor with bolts provided.

Check that the sensing wheel rotates freely. Holding the sensing wheel arm down, close and lock the DSR. Recheck that the sensing wheel rotates easily as the dome turns.

DDW Processor

The DDW control unit is enclosed in a steel box that may be mounted direct to the wall. Our “standard” location is next to the power supply, so that the power connections will be short. Remove the main panel in the box (screws at corners). Use

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the holes in the box to determine the mounting hole locations. Drill 9/32 holes, and install box with bolts provided. Remount the DDW panel. If you use your own screws or bolts, be sure they do not project too far into the box.

Note that DDW control unit has a power switch (used as the ALL STOP” control) on the outside of the enclosure, and one on the inside. The outside switch allows the user easily to turn the unit off or on. Because the DDW enclosure can be padlocked, the inside switch and controls can be protected from unauthorized use.

The printed circuit (PC) board within the DDW control unit includes a master power switch with three positions: Local/Off/Remote. The board also contains the relays that operate the motors, jacks for signal cable, LED indicator lights, and switches to configure your setup. This will all be discussed below. DO NOT OPERATE the DDW until all parts are installed.

End of Motion Sensors

Your DDW will normally be supplied with magnets and Magnetic Reed Switches, operated Normally Open, that control a Shutter Relay Box. When a sensor activates, the Shutter Relay is opened so that the shutter motor stops. As an alternative, some installations will use micro-switch End of Motion Sensors, which are discussed in an Appendix.

When you open or close the shutter, voltage is applied to the Shutter Relay, which turns on the ES motor (the polarity of the applied voltage determines whether the motor direction turns to open or close the shutter). The open/close shutter operations continue until the motor “shuts itself off”. This is accomplished by installing two normally open magnetic reed switches on the underside of the rear cover near the shutter motor. Each switch closes when its companion magnet mounted on the shutter is within 2 inches of the reed switch. A key feature of the switches is that the alignment of the activating magnet on the shutter and its respective switch is not critical and activation is possible without physical contact.

See figure for appropriate installation locations. Use tape for temporary installation of sensors and magnets. Once installation is set, you **must** use screws to hold sensors and magnets in place. The screws are flat heads, so you must countersink the holes on the white side of the shutter.

As you install the magnets and switches, you may use an ohmmeter to check switch operation vs. magnet spacing, or you can use the Shutter Relay box itself to detect the sensor operation. To do this, temporarily disconnect the shutter motor. Temporarily connect the DIRECT power supply leads to the sliding contacts. Depending on the polarity you have connected, bringing the magnet close to the correct sensor will cause the relay to click loudly.

The Open sensing **switch** mounts on the blue underside of the rear cover, under the right end of the lip. The actuating **magnet** attaches to the blue underside of the **front** shutter. This magnet is custom made and is quite strong to give good distance activation of the sensor. As the shutter slides back and the magnet comes within about 2.5 in. of the sensor, the sensor closes and operates the shutter relay to cut off the shutter motor. The shutter coasts to a stop. Use #22 wire to connect the sensor to the Shutter Relay. Polarity does not matter.

The Closed sensing **switch** also mounts on the blue side of the rear cover, forward of the rear latch hole. The actuating **magnet** mounts in the rear (white) latch itself in a deep groove or channel that you cut in the latch (this may be precut at the factory). This magnet is a standard magnet about 3/8 in. diameter.

Here is a method of putting the magnet into the rear latch. Cut the groove with a hand drill with a drill or router bit, or by hand with a chisel (removing the top shutter makes the job much easier). The plastic is very tough, but fairly soft and easy to cut. The groove should be deep enough to enclose the magnet, and should be about 9/16” behind the front (point) of the latch. A clean, neat hole is not needed! When complete, insert the magnet. Use epoxy or hot glue, screws, or other means to hold the magnet in place. Be sure the epoxy or other material does not project above the latch surface.

Temporarily locate the sensor so that it activates when the shutter comes within 1/2 in. of fully locked. Connect sensor to Shutter Relay as above.

You can mount the Shutter Relay Box next to the shutter motor with a 1/2 in. flat head bolt. Shutter power from the contact plates feeds into the Shutter Relay Box to the marked terminals. A two-foot #14 cable (provided) then connects to the shutter motor (be sure you have removed any preexisting wiring to the shutter motor). For larger domes, it may be more convenient to mount the Shutter Relay close to the sliding contacts where service will be easier.

You may test this system using either the usual shutter toggle switch or manual movement of the shutters (not yet the DDW unit). The shutter should open fully, trip when the magnet is about 2.5 in. from the sensor, and coast to a stop. When closing, the shutter should fully close, the rear latch should drop into place, and the shutter motor cut off. Check that the latch is FULLY engaged (if not, change the location of the close sensor).

Notes if installing DDW after your dome has been fully assembled: The bolts that hold the magnet, sensors and shutter relay box to the rear cover must be flush with the outer surface of the rear cover. If not, they might block your shutter from a smooth opening/closing. That is why we provide flat head bolts. You must remove the shutter to countersink the holes for these bolts. If this is not feasible due to your dome's height or other reason, you can ask your local building supply store for screws that have very flat or very low profile heads. For example, ask for "button cap allen head screws" or "socket cap screws" or "truss head screws". You'll need 6-32 screws for the sensors and 1/4-20 screws for the shutter relay box.

DSR Interlock

The DSR Swingout must be closed and locked before rotating the dome away from Home. The position of the DSR is checked by DDW when the dome is in the Home position and has received a command to move away from Home.. DSR position detection is done by a magnet on the Swingout that closes a magnetic reed switch on the adjacent latch receiver. Detection is via a wire that connects the magnetic sensor to the DDW through the Shutter Relay box to the sliding contacts. If your HomeDome model does not have a door/Swingout, you will not install a detection switch, but instead connect a short wire between the DSR terminals inside the Shutter Relay box. See DSR I/L Figure for details, and read DSR I/L section below for wiring.

Motor Capacitors

On older models of shutter and rotation DC drive motors, (pre 2004), you may need to solder a capacitor (provided when needed) between the motor terminals on each motor. If not already installed, use a good soldering iron or gun and good solder to assure stable, solid contacts. These capacitors help reduce electrical noise that may affect the DDW operation.

Entry Switch

If you enter your observatory from "underneath", you do not need an external entry switch. However, if you enter your observatory from the outside, you probably have installed your power supply through the outside wall, so that you have use of the external shutter switch to open and close the observatory. In that case, you use the power supply key switch to turn the power supply on/off. Because the DDW uses the power from the power supply, the power supply and DDW must be left turned on, but you will normally want unauthorized persons not to be able to operate the shutter. You will need to use an external entry switch that can be installed in two different ways:

- You may remove the power supply from facing outward, turn it inward (where you can leave it on), and install the entry switch and light in the vacant holes. You can then leave the shutter motor (but not the rotation motors!) connected to the power supply in parallel with the shutter power wires from DDW. In this mode, if the power supply and the DDW are energized for opposite motions (e.g., shutter to open and close at the same time), the power supply will “see” a short circuit and its circuit breaker will trip, removing all power from the dome. This is a very unlikely event, and can occur only when someone is doing local power supply switch operation at the same time there is a remote command. The major reason for wiring in this manner is to allow entry into the dome using the power supply shutter control switch, and to allow entry even if the DDW is off.
- You may leave the power supply in place leaving the key switch on and key removed. To avoid unauthorized entry, you would disconnect the shutter wires from the power supply and use the entry switch and DDW controls only. You would then install the entry switch and light in new holes. This alternative is generally preferred.

After you choose your setup, install the entry switch and pilot light in the outside wall, preferably under the shelter of the front shutter to reduce the risk of water entry. The polarity of the wires will be adjusted later.

Cable Connections

Refer to the figures for cable connections. All wiring to be connected is low voltage (12 volts or less). Most cables and wires are either preexisting and are simply moved, or we provide them for you. In general, we refer to *power wires* or cables that carry relatively high current (such as those that feed the motors), and *signal cables* that transmit low current (such as those carrying commands to and from the DDW, PC, and telescope. All signal cables are 6-conductor telephone type cables, with standard plugs on each end.

WARNING: Do not use standard commercial telephone type adapters or cables. Most of these are not suitable because they flip wire colors at the terminals for telephone purposes. Our cables require that all wires run straight through. You can order cables from us, or purchase an inexpensive crimping tool, cable, and connectors (6C6P) and do your own. See Appendix 2 for details.

- **Main Power.** Power for DDW comes off the DIRECT terminals of the power supply (**Disconnect the power supply from the wall outlet while working inside!**). This should be at least #14 wire, and a three foot length is provided. Minus from the power supply goes to Ground (-) of the DDW unit.
- **Rotation Motors.** Move the rotation wires from the power supply (top switch) to the DDW terminals. If you leave the power supply rotation switch in parallel with the DDW rotation, you will damage the DDW whenever you operate power supply rotation. We will deal with wiring polarity later.
- **Shutter Motor.** Move the shutter wires from the power supply (front switch) to the DDW terminals. If you leave the power supply shutter switch in parallel with the DDW shutter, you can operate safely only if you never operate DDW shutter and power supply shutter at the same time (if you err, you will put a short circuit on the power supply). Again, we'll deal with polarity later.
- **End of Travel (EOT) sensors.** Connect the small wires from each sensor to the marked terminals in the Shutter Relay. Polarity does not matter.
- **DSR Interlock.** See the figure. Using double back tape, attach the DSR magnetic sensor to the latch receiver and route its small wires around the equator flange to the DSR inputs of the Shutter Relay. Attach the magnet to the Swingout. When the Swingout is closed, the magnet and sensor should be within 1 in. of each other. . If you have no DSR Swingout, insert a shorting wire on the DSR interlock terminals. Note: failure to install the DSR Interlock or shorting wire will result in error messages to be displayed and will cause DDW operations not to find HOME.
- **Hand Control.** The hand control connects to the DDW using a ten-foot length of 6 conductor cable provided.
- **Azimuth Sensor.** The sensor connects to DDW using the ten-foot cable provided.

- LX200. If you are using an LX200, you may use our LX200 Adapter to connect. Connect a cable from the PC (using a PC1/SBC adapter) to the LX200 Adapter, and a second cable from the LX200 Adapter to the scope. If you wish to use the DDW scope interrogate mode, also connect the DDW to the LX200 Adapter. Use our cables only: Do not intermix Meade or other cables or adapters into this system—they are wired differently!
- PC-DDW. Use a PC1/SBC adapter and cable to connect the PC to the DDW. This cable provides the operating connection from your computer to the DDW. USB to serial adapters work very well if there is no port available.
- Emergency Shutter connections. Although unlikely, it is theoretically possible for all electronics and/or power inside the observatory to fail. In that case, to enter the dome you would need partially to disconnect the shutter cable system. To avoid this, you may want to use some spare #14 wire to connect the shutter motor to a pair of the electric shutter mounting bolts that protrude to the outside. In case of electrical failure, you can then from the outside apply 12V directly to the motor to operate the shutter.
- Entry Switch. Connect one side of the entry switch/LED cable to DDW ground, and the other end to the UNiversal input terminal. Leave switch OFF (CCW). We'll deal with polarity later.

NOTE: We provide nominal 10-ft. signal cables with telephone plugs to connect your PC to DDW. If you want to run longer cables, you can request them from us or easily build and install your own: See App.3 for more discussion. If you are at a substantial distance, say, 100 ft or more. you may need to run the cable in some type of conduit underground. See a local electrician or electronic technician for details and suggestions. The cable for the RS232 can be almost any reasonably low capacitance, three (or more) conductor cable, for example, twisted shielded pair. For long runs, use reasonably large wire (e.g., 20 gauge conductors). Although we have provided adapters for the computer end so you can use telephone type connectors, you may instead want to use solder type connectors as they allow a wide choice of wire types. If you use the proper gender connectors (e.g., DB9 Female on the computer end of the cable and a DB9 Male on the DDW end), then you can use the cable and adapters provided with DDW to make the connections. The wiring is simple: connect pin 2 to pin 2, 3 to 3, and 5 to 5 (pin 5 is ground). Also, connect pins 7 and 8 together on the end to be attached to the PC. Cable and connectors are available at Radio Shack and other outlets.

Note that these directions are valid for cables connecting to our equipment. Serial cables for other accessories, telescopes, CCD cameras for example, may require additional or different connections for a long cable.

Optional Installation Items

Optional items can be added later, if desired. This section provides a summary of the available items. Some of the options can be installed using locally procured parts. All are available from us if you desire.

Remote All Stop. If you have a large dome, or many people present, the single All Stop switch on the DDW and B5 on the hand control may not provide the safety you need. You can add as many additional switches around the dome as you wish. Simply use any good toggle switch(es). Wire them in parallel between the All Stop on the DDW terminal strip and ground. The All Stop LED on the DDW board will indicate when any of these are activated.

Remote Slave. If you should want a manual slave switch in the observatory (other than B5 on the hand control), you can wire a push button or switch to the Slave terminal on the DDW terminal strip to ground.

Remote Power Module. The remote power module allows the user to turn on or off four 120VAC, (or 240VAC), outlets in the dome on/off remotely using the User I/O lines. The module comes with its own installation and use instructions.

Weather Station. The Weather station option allows the user to monitor the weather at the observatory. When properly configured, the DDWCP will monitor the wind and other functions, and will close the dome when weather conditions are poor. The weather station option comes with its own installation and use instructions.

Remote Reboot. The Reboot module uses a signal from the DDW to reboot the InDome PC in event that the PC crashes. The module comes with its own installation instructions.

Install DDWCP in Computer

The Digital Dome Works control program (DDWCP) is provide on a CD with other software from Technical Innovations. See the file “readme.txt” for installation instructions. Once installed, your software includes a Help screen, which is a soft version of this manual. The latest version of DDWCP can also be downloaded as a zip file from <http://homedome.com/downloads>.

You will normally want to run DDWCP whenever running your telescope and CCD. Therefore, install in a convenient folder in Windows with other programs in your astronomy group or add an icon to the DeskTop.

Initial Checkout

To achieve a reliable remote control facility, you must install items carefully, and then test the system thoroughly to catch any problems. We strongly recommend that you test every function listed below from inside the dome, first manually, then with software commands using a computer inside the dome where you can see what is happening. If you find a problem, review your work, apply reasonable diagnostic procedures, or call us for assistance. Do not operate the DDW system if there is a problem. You will be much more efficient if you follow a methodical checkout process!

If a problem develops during testing, be prepared to quickly switch off the DDW using the front panel switch and/or power supply--this will stop all motion other than that directly controlled by the four hand control buttons. When DDW is switched on again, it will be in a non-moving mode.

IMPORTANT NOTICE: Before you begin testing and using DDW, you must understand that there are two automatic shutdown modes built into Digital Dome Works. Read the sections on “Communication Cutoff Shutdown” and “AutoShut” in the Trouble-shooting/Interlocks section of Chapter 3. You need to know the conditions for an automatic shutdown, and how to activate the “All Stop” command or switch. If you are doing any work on the dome motors or other moving parts of the dome, put the “All Stop” switch on the DDW box in the OFF position.

Before we start, lets review the logic of the internal DDW power/mode switch. The operating modes are:

- **DDW OFF.** Whenever the main power supply is on, the four motor buttons on the hand control WILL still operate. These buttons control the motor electronics and relays directly, and completely bypass the DDW operation. Therefore, the DSR Interlock does not operate when using these buttons. It is assumed you are in the dome, and know that the DSR is open or closed. The four buttons are powerful: be careful! B5 is inoperative.
- **DDW Local.** In Local mode, the DDW processor is on, and can respond to computer requests for information. However, motion commands via computer (DDWCP) or via the DDW processor (timeouts, B5, entry switch) are inhibited. This mode is primarily for continuing DDW operation while working in the observatory when one does not want the dome to move except under control of the four motion buttons on the hand control.

- **DDW Remote.** In Remote mode, all motion commands are operational. If working in the observatory while someone else is at the computer, or if slaving is turned on, the dome MAY OPERATE WITHOUT WARNING. Be careful, and always know how to turn off the DDW (i.e., the All Stop switch).

Now let us proceed with initial tests with the DDW OFF.

DDW OFF Tests

- **Review Wiring and Installation.** Carefully go over all the installation steps, and check that they were done correctly.
- **Wiring Check.** Leave the DDW Remote/Off/Local switch OFF. You will do several tests by using the four motor buttons on the hand control. These control the relays directly even when the DDW is off. In this mode, the DSR Interlock does not function, but the Shutter end of travel interlocks do operate. With the DDW off, plug in the hand control.

Briefly push the CW button. The dome should turn CW. If it does not, reverse the rotation wires at the DDW terminals. When turning clockwise, no relays operate.

Briefly push CCW. When turning CCW, the reverse relay operates.

Briefly push OPEN. Shutter should begin OPENING. If it begins closing, reverse the shutter wires at the DDW terminals. When opening, only the shutter relay operates.

Briefly push CLOSE. Shutter should begin closing. When closing, both the shutter and reverse relays operate.

DDW Local Tests

Perform these tests so that you or an assistant can monitor the dome action and let you know what is happening. You will be working directly with DDW hardware.

Flip the interior DDW switch to LOCAL. The DDW front panel power switch should turn it on and off as shown by the blinking pilot light on the DDW board. The light on the hand control will blink, indicating LOCAL mode.

You will now check that the shutter motion interlocks (magnets and magnetic switches) operate properly. You will first check the shutter OPEN (End of Travel) switch adjustment:

- Use the hand control OPEN button to begin opening the shutter (if the OPEN button makes the shutter close, reverse the shutter wires at the DDW or the sliding contacts).
- As the shutter is opening (but before it is all the way open), simulate activation of the OPEN magnetic switch by having an assistant short across its terminals with a wire or clip lead. The motor should stop even though the OPEN button is still pressed.

If the motor keeps running, STOP and fix the problem: First check the wiring: Check that the wires from the OPEN magnetic switch in fact are connected to the OPEN terminals on the shutter relay. Even if the wires enter the OPEN terminals, you may have the wires pushed in so far that the wire insulation is under the contact, thus preventing proper electrical contact.

If the wiring is ok, try shorting the CLOSE terminals while opening the shutter. If this causes the motor to stop, reverse the wires at the shutter motor terminals (not at the power supply or sliding contacts). Now the shutter and contacts are wired correctly.

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- Now run the shutter all the way open--the magnet on the front shutter should activate the OPEN switch and stop the shutter when it is full open. If necessary, adjust the switch and/or magnet so that motor stops at least 1 in. of travel before shutter hardware strikes the rear cover (and stops the shutter).

Now you will check the shutter CLOSED switch adjustment:

- Use the hand control CLOSE button to begin closing the shutter.
- Simulate activation of the CLOSE switch as above.
- Run the shutter closed--the switch should stop the shutter motor just before full closure and lock, so that it will coast to a full closed and locked position. Verify that the shutter latches are **fully** engaged (locked) at this time. Adjust the magnet and/or switch as necessary for correct operation.

Once the switches and magnets are properly adjusted, mark the locations carefully, then install the permanent mounting screws. Do not use the dome with only tape holding these essential components in place!

Note: Be sure the local tests are satisfied before you move to the more complex remote operation.

DDW Remote Tests

Now you will check the system first by using B5 on the hand control and the entry switch, and then the DDW software running on a PC or laptop in the dome.

- Flip the interior DDW switch to REMOTE.

You will have noticed that the hand control has a pilot light and a fifth button. The pilot light lets you know that the DDW is operational in the Remote mode. The fifth button (we call it B5) provides you with a variety of convenient functions - there is magic in that fifth button! Note that when you push the button, the DDW pilot light on the hand control will go off. Conversely, if the light is off, then B5 is not available for use, (for safety reasons, B5 functions will NOT operate in Local mode). B5 is easy to use, but it does work differently from most buttons.

B5 does multiple functions depending on what the dome is doing (moving or not) and how you operate the button.

If the dome or shutter is moving:

- **STOP.** Touching B5 will STOP any motion and cancel any current movement commands.

If the dome or shutter is NOT moving, when you PUSH B5, you are telling DDW that you are about to issue a command, then how long you hold B5 determines what DDW will do. That is, the actual command is created when you LET UP on B5, not when you push it.

- **HOME:** Assuming the dome is not moving and is not home, if you hold B5 you will hear a beeper from DDW. After about one second, the beeper will stop. If you now release B5, the dome will return home automatically.
- **OPEN/CLOSE:** If you push and keep holding B5, you will hear the first beep, then silence, then a second beep. If you wait to release B5 during or after the second beep, the dome will go home AND will then close (if full open), or will open fully (if either full or partially closed) the shutter. If the dome is already home, this operation will skip past the HOME action. Of course, during any operation, just touching B5 will stop the motion.

- **Slave ON/OFF.** Assuming the dome is not moving, a quick double tap of B5 will turn the slaving on or off. You will get two brief beeps for slaving on, and one beep for slaving off. Note: If you find yourself pushing B5 rapidly or multiple times, DDW may interpret your actions as turning slaving on or off, and the dome may start turning. Just tap B5 to stop the action, then take your time with your next command. Always wait three seconds before another B5 command.

Let's try out some of the functions. If the DSR is closed, use the CW or CCW button to move the dome away from HOME (remember-the DSR interlock does NOT function when you are using the manual rotation buttons). Then operate B5 to make the dome go HOME and close the shutter. During the operation, operate B5 to prove that it will stop the motion.

The entry switch, (if used), operates in parallel with and identically to B5. That is, turning the entry switch ON, (CW), is like pushing B5, while turning it OFF, (CCW), is like releasing B5. If the entry switch is left ON, B5 will not work and its pilot will be off: The entry switch should always be left in the OFF, (CCW) position.

Before initial testing of the entry switch, check whether its pilot light is on. If it is not, reverse the leads to the entry switch and light. To test the entry switch, simply use it to make one of the same operations you used with B5 above.

Note: Be sure the system operates properly with the above tests before proceeding.

Now let's turn to the computer screen and DDWCP. Review the operating instructions (see next chapter) for the functions of the DDWCP program. Activate the DDWCP in your computer. You should see the control screen as shown in the operating instructions (shown in the next chapter).

- Check the DSR Interlock. Before we operate the rotation with the computer, we need to check that the DSR interlock is operational. With the dome at Home and the shutter full open or closed, open the DSR Swingout. Click GOTO on the screen and type in an azimuth and hit enter. The dome should refuse to turn. If it does move (in violation of the protective interlock), stop immediately and fix this problem before operating the observatory. Re-close the DSR.
- Assuming the shutter is open, click the "Close" button on the screen. The shutter should begin moving. Immediately activate the STOP button. The shutter should stop immediately.
- Click the close button again. The shutter should go to the end of travel, and the screen should show the proper information.
- Click the GOTO (rotation) command. Read the dome current azimuth from the screen and enter a GOTO that is at least 25 degrees away. The dome should rotate to the desired azimuth, using the shortest direction. The screen should show the dome turning. Note that we have not yet trained the dome, so the GOTO may not be accurate.
- Activate the HOME command. Dome should rotate to Home (even though it has not been trained).
- Activate the ShowData button. This will show a small screen displaying recent commands to the DDW and responses from it. Use GetInfo or operate the dome while watching the data flow. Use this screen regularly to familiarize yourself with proper operation and for diagnostic purposes.

This completes the basic tests of the DDW.

WARNING: You will still need to train the dome, as well as enter any special configuration information needed, as discussed in the operating instructions that follow. Until the dome is trained properly, HOME commands will work, but all goto functions (including slaving) will be incorrect. Training should be the next thing you do, but only after (!) you review the control program functions described in the next chapter so that you have a more complete understanding of what is going on.

Ch. 3. Operating Instructions

IMPORTANT NOTICE: *Before you begin testing and using DDW, you must understand that there are two automatic shutdown modes built into Digital Dome Works. Read the sections on “Communication Cutoff Shutdown” and “AutoShut” in the Trouble-shooting/Interlocks section of Chapter 3. You need to know the conditions for an automatic shutdown, and how to activate the “All Stop” command. If you are doing any work on the dome motors or other moving parts of the dome, put the “All Stop” switch in the OFF position.*

This discussion is in several parts:

- Local (non-computer) Operation
- Remote Operation
- Interlocks/Trouble-shooting

Local Operation

If you are outside the dome and want to open the shutter locally, you will not normally have access to the hand control. Simply use the normal external shutter switch on your power supply to operate the shutter. Note that this wiring for this circuit is in parallel with the DDW shutter circuit. If the remote control commands “close” at the same time you manually try to “open” the dome, the power supply will be shorted and the circuit breaker will trip (this would require opening the dome as if it had a failed shutter). As described in the installation chapter, an alternative entry method is to install a key switch that operates the same as B5 on the hand control. This will allow you to open or close the dome from the outside.

DDW has a power switch (used as the ALL STOP” control) on the outside of the DDW control unit, and one on the inside. The outside STOP switch allows the user easily to turn the unit off or on. Because the DDW enclosure can be padlocked, the inside switch and controls can be protected from unauthorized use. The inside switch (on the PC board) is a master power switch with three positions:

- Off
- Local
- Remote

In the **Off** position, power (normally from the 12 VDC observatory power) is not applied to DDW. However, shutter and rotation power are still available on the power relays for rotation and shutter. One can use the shutter and rotation buttons on the hand control (if the panel ALL STOP is not activated), and the motors will operate. When opening or closing the shutter, the automatic stops function. In the **Off** position, B5 on the hand control will not function, because B5 works through the DDW processor, which is turned off.

Note: if you want **all** functions to be off, even including the hand control, turn OFF the ALL STOP panel switch, the circuit breaker at the lower right of the circuit board, or the main power supply for the system.

Note: when using the hand control to move the dome away from Home, when the DDW is off it cannot check the DSR Swingout Open/Close status. Be careful that the DSR Swingout is closed before turning the dome.

In the **Local** mode, power is applied to the DDW. Remote computer commands will be received by DDW and software response will be given back to the computer; however, all movement and slave commands will be ignored. Timeout functions will be bypassed in local mode. The manual hand control buttons function as in the Off mode.

Local mode is primarily for when you are in the dome, want the DDW connection to the computer, but do not want DDW motions except for using the four manual motion buttons on the hand control.

In the **Remote** position, movement commands from the control computer will be processed by DDW, while local (manual) hand control commands will continue to function. We will discuss each Remote mode according to the source of the movement commands:

- B5 on the hand control and external entry using B5 logic
- DDW interlocks (e.g., if communication timeouts leads to auto closing)
- Non-computer Slaving (using the interrogation of the scope)
- Computer Directed Operations using DDWCP and an RS232 connection

Hand Control Operations

In this section, we summarize the functions available in the hand control. Comments made for the B5 and its pilot light apply as well to the entry switch and its pilot light.

The Rotation buttons (CW and CCW) operate the relays directly to turn the dome to the right (CW) or left (CCW). Rotation occurs as long as the button is held. If both buttons are held, the dome turns CCW. Because these buttons do not use the processor, as long as power is on into the DDW (and the ALL STOP panel switch is not activated), the rotation buttons will still function even if the Local/Remote switch is off. The DSR interlock does NOT function when the hand buttons are used.

The Shutter buttons (open and closed) operate the relays to open or close the shutter. Shutter movement occurs as long as the buttons are held, or until the shutter reaches EOT (end of travel). If both buttons are held, shutter opens. Because these buttons do not use the processor, as long as power is on into the DDW, the shutter buttons will still function even if the Local/Remote switch is off.

Pilot Light (Heart beat)

- Is off when DDW is turned Off, or when B5 is pushed or if Entry switch is closed.
- Is on when DDW internal power switch is in Remote mode (Remote allows remote computer operation and B5 actions)
- Dim blinks when DDW is on but inhibited from motion commands (Local mode)
- Off when All Stop panel switch activated.

B5 (and the entry switch) controls a variety of functions, but because it uses the processor logic, it only operates when the DDW is in the Remote mode. B5 does multiple functions depending on what the dome is doing (moving or not) and how you operate the button. Caution: Because of processing time in DDW, wait three seconds after a B5 command before trying another. If you don't, DDW and you can become confused!

B5 Button

If the dome or shutter is moving:

- **STOP.** Touching B5 will STOP any motion and cancel any current movement commands.

If the dome or shutter is NOT moving, when you PUSH B5, you are telling DDW that you are about to issue a command, then how long you hold B5 determines what DDW will do. That is, the actual command is created when you LET UP on B5, not when you push it.

- **HOME:** Assuming the dome is not moving and is not home, if you hold B5 you will hear a buzzer from DDW. After about one second, the buzzer will stop. If you now release B5, the dome will return home automatically.
- **OPEN/CLOSE:** If you push and keep holding B5, you will hear the first buzz, then silence, then a second buzz. If you wait to release B5 during or after the second buzz, the dome will go home AND will then close (if full open), or will open fully (if either full or partially closed). If the dome is already home, this operation will skip past the HOME action. Of course, during any operation, just touching B5 will stop the motion.
- **Slave ON/OFF.** Assuming the dome is not moving, a quick double tap of B5 will turn the slaving on or off. You will get two brief beeps for slaving on, and five beeps for slaving off. Note: If you find yourself pushing B5 rapidly or multiple times, DDW may interpret your actions as turning slaving on or off, and the dome may start turning. Just tap B5 to stop the action, then take your time (wait three seconds) with your next B5 command.

As discussed in the installation instructions, depending on your installation, although you can operate the shutter to allow entry either using your normal power supply control of the shutter, the normal way is with the entry switch using the B5 logic. This switch is wired directly in parallel with B5, using the B5 terminal strip connection on the DDW board (see schematic diagram). If the DDW is set to Remote, you can then leave or enter the dome using the entry switch.

Entry Note: if you use the entry switch to open the observatory, and do not then start DDWCP to connect to DDW, automatic closure remains NON-activated: That is, the observatory will stay open. If opened manually, always either close it manually as soon as possible, or activate DDWCP.

Non-computer Slaving Operations

It is possible to operate the dome in the slaved mode with an LX200 scope **without** using a computer to control DDW. In this case, you would open the dome, and establish your computer control of the telescope only. When slaving is activated (assuming you have the LX200 Adapter connected), either from B5 or DDWCP, DDW will interrogate the scope to obtain the desired azimuth, and turn the dome to the correct azimuth. This mode is not available in Local mode because local mode blocks all DDW processor motion commands.

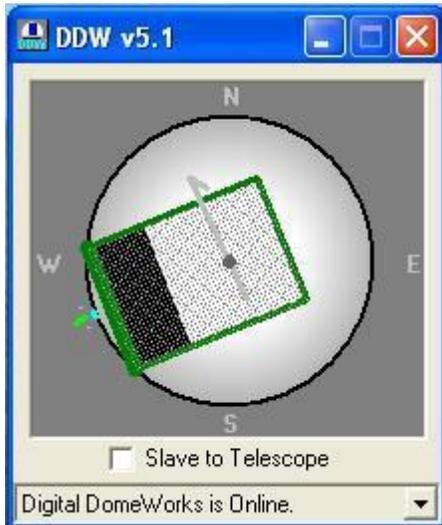
This non-computer slaving mode is suitable for any scope using the LX200 command set, so long as setting the dome azimuth to the scope azimuth is sufficient to keep the shutter opening in front of the scope. If the pivot point of the scope mount is not near the center of the dome, this method may not accurately keep the dome shutter in front of the scope. If so, you may have to use the remote computer control to do accurate slaving (this will compensate for off center mounts).

Computer Directed Operations (i.e., remote operations)

In remote operation, the user can control the observatory via the RS232 serial lines (or over a network, etc.) using the User Computer. This requires that the user computer be relatively close to the dome (several hundred feet). If longer distances are required or cabling is a problem, you may have the user computer connected to an in dome computer, which is connected to the observatory components by RS232 cables in the dome.

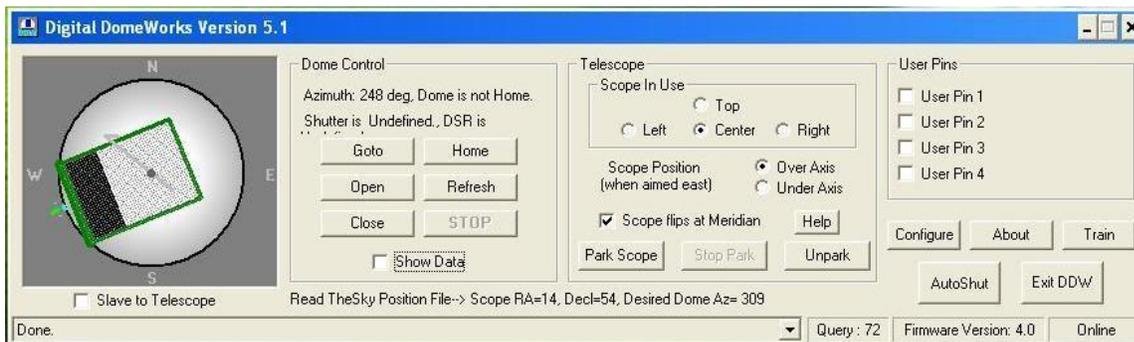
In any case, the software to control the scope and CCDs is the choice of the user. The software to control DDW is usually our own DDW Control Program (DDWCP) included with the system, or it may be designed by the user or purchased from third party sources.

To use the DDWCP, select and run it as you would any other Windows program. After a few seconds, you should see a screen such as shown below. The screen contains a schematic of the dome, a “Slave Dome” check box to turn on and off slaving to the telescope, and a DDW status message box. This initial display screen was designed to be as compact as possible in order to allow it to remain open on the Windows Desk Top with minimal interference with other program screens that are open.



To open the full Main DDW screen, containing data from the dome, and control buttons for different actions, simply right click with the mouse anywhere within this screen display. The “expanded” Main DDW screen is below. As we discuss the various functions, we will also describe how data moves through the system and the design considerations of the system. This will help the user understand the capabilities and the limitations of the system.

Main Screen -Schematic of Observatory



The most obvious part of the screen is the schematic of the observatory. North is at the top of the screen. A green tic mark will show the HOME position of the dome (in this case 16 deg). The dome may be shown at a particular azimuth angle, and the shutter may be shown as closed, open, or in between. These data are also shown as text in the area below the schematic.

This data are accurate to the best of DDWCP's knowledge because the computer and DDW rely on periodic queries and responses. There are special circumstances that may make the data incorrect or indeterminate. For example:

- The DDWCP screen will only have data from the last query for information from DDW in the dome or from the last action commanded by DDWCP. If someone in the dome has manually turned the dome, the data shown may not be correct. It will become current and correct when the control program information automatically updates (every hundred seconds), or if a command or GETINFO is sent from DDWCP.
- The shutter and DSR data are only obtained when the dome is HOME and the shutter is operated. Thus, if the DDW has been turned off, then on, the shutter status will remain indeterminate until the dome is sent Home and the shutter operated (DDW determines the shutter position by the occurrence of the shutter motor cutoff during full open/close operation when the shutter reaches end-of-travel (EOT)). In these cases, the shutter and DSR data are correctly labeled as "Indeterminate". If you see "Undefined", try opening or closing the shutter to obtain updated shutter status data.

About

The "About" button brings up a screen that gives the version number and date of the DDWCP. You may also take note of the date of the version which is also given. The specific version of the DDWCP is the date of the revision

HELP

The HELP button gives access to a DOC version of the instruction manual. This button starts a copy of Word Reader, and brings up the manual. This includes almost the entire manual (including schematic diagrams), with links to the table of contents, and a key word search facility. Because we make frequent updates to the manual, this version may not be quite as recent as your official paper instruction manual. Compare the dates on page 1, and refer to the "Changes" appendix in the paper version to identify the differences.

Events Box

This box shows a running list of commands given via software, or events built into the DDW, and the status of the system response. Clicking on the drop down arrow at the right will display the command history log window.



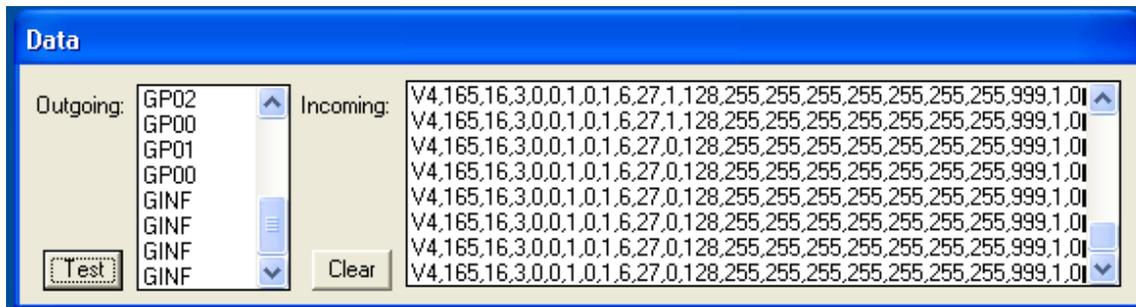
DOME CONTROL

Show Data Check Box



This check box opens a small window above the main screen that will show the characters being communicated between the PC and DDW. Using App. 1 as a

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 reference, Show Data is useful in diagnosing communication and operational problems.
 Operate this screen so that you become familiar with normal operation.



Some of the information and diagnostics you can get include the following:

- Get Info to DDW will result in the information packet in return. You can use the guide in App.1 to interpret the raw data returning from DDW. You can use these data to evaluate training and other operations.
- When you train the dome, check the information packet. In this case, the DDW firmware is V4, the dome is 165 “ticks” in circumference, home is at tick 16 CW from North, the coast distance is 3, and the current location is tick 131 CW from North. If you saw a circumference of zero after training, you will immediately know there is a training problem (and why the dome won’t go where you want!).
- When rotating the dome by hand control or computer, you will see an L or R to show direction, then detection of ticks from the azimuth sensor (shown as P1, P2, etc.). If you do not see these data, almost surely the azimuth sensor or cable is at fault. Note that DDW uses AZ ticks and motor current to distinguish rotation from shutter movement, so AZ failure can cause shutter ticks when rotating!
- When operating the shutter, you will see an “O” or “C” followed by shutter timing ticks from the DDW shown as the letter “S” about once per second.
- A “TEST” button brings back diagnostic data from DDW. See App 1 for interpretation.

Refresh Button

Clicking on this button tells DDWCP to query the DDW to transmit the most current status information on the shutter, azimuth position, interlocks, motor current, etc. Remember that DDWCP automatically queries for this information about every hundred seconds. The time remaining before the next query is shown above the event box. You can change the query rate by the adjacent buttons. We recommend using the maximum except when shorter times are necessary for diagnostic purposes.

Rotation Control (“Goto” button)

You may command the dome to turn to a particular azimuth by clicking GOTO and entering the azimuth in degrees (Clockwise from North). DDW has a dead zone (set by DIP switches on the DDW board) to avoid unnecessary “jogging” of the dome. Thus, if the dead zone is set to 10 degrees, and the dome is at 175 and you command 180, no action will occur. Once motion begins, the dome will turn to the desired azimuth. The Automatic Offset, which would normally cause the dome to rotate past the new setting, is deactivated for GOTO commands.

DDW will beep three times before rotation moves.

When a command orders the dome to rotate to a given azimuth, the dome will begin rotating in the shortest direction to the goal. The motors will cut off a distance before reaching the desired azimuth to allow for coasting. There are other more subtle details in how DDW manages the rotation which are discussed below.

The STOP button can be used to stop motion at any time. For example, the Open button will begin the cycle of opening the shutter, which will run until the end-of-travel cut-off switch stops the motion. At any time during this cycle, the Stop button will end the process and the shutter opening can resume once the Open button is pressed again. (Or Closed with the Close button). Note that pushing B5 during any movement will also stop the movement.

Home Button

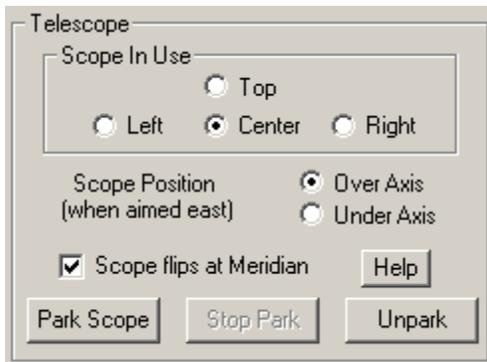
You may command the dome to return Home (it will take what it believes is the shortest direction). Once the dome has started Home, it will seek the contact plates (or Home Switch) which signal the physical Home position (ie., dome training does not affect home seeking). As soon as the dome reaches the contact plate, the dome drive stops and coasts to a halt and will attempt to stop in the center of the contact plates. If the dome overshoots Home, the motors will “jog” forward one time, then backwards using 0.1-1 sec pulses (up to ten times) to find Home.

Because the shutter sliding contact plates are used to define the Home azimuth, the azimuthal length of the plates could contribute to the azimuth error. When you TRAIN the dome, DDW will measure the location of each end of the contact plates, and will define the HOME azimuth position at the midpoint, and all azimuth measurements are made from that point.

TELESCOPE CONTROL

Scope In Use

There can be up to four telescopes identified and selected inside the observatory. The position offsets (see “Configure” entry section later in manual, allows the calculation and entry of the parameters needed to center each scope as closely as possible in the shutter opening during operation and slaving. The operator then simply selects the scope in use with the check box option (see “Telescope” section of DDW Main screen below). In observatories with one telescope, the “Center” position is selected.





When using a computer controlled German Equatorial mount, the mount motion can be “**tracking**” (following stars) or “**slewing**” (executing a GOTO). Depending on the design of the mount, the scope may flip automatically or manually as it passes the meridian, especially during slew operation. Imagine the scope aimed to the east over the “top” of the polar axis (as is normal). As the mount tracks, the scope rises toward the vertical, then “turns over” backwards as it rotates around the polar axis. Thus, 8 hours after you started, as the scope looks to the west, the scope will be underneath the axis (if it did not bump the pier!).

Note our naming convention: Although the scope rotated around the polar axis, it did not flip, and our convention is that it is still in the EAST OVER AXIS mode (thus west under axis is the same as EAST OVER AXIS).

However, most users want the scope on top when looking either East or West, implying a flip at the meridian. Some GEMs (e.g., Astrophysics) if started on top when aimed East, will **track** past the meridian without flipping, but if slewed with a GOTO command to a point past the meridian will flip automatically during the slew. Other mounts require manual flipping, while still others ignore the issue altogether.

DDWCP must know whether the scope is above or below the axis, and how the mount behaves, so that it can compute the proper dome azimuth to deal with the German offsets. How does DDWCP know this? The answer is: it does not, unless you tell it via the GE Mount Flip box.

- If the scope is on top when aimed East, check Above Axis. If the scope rotates past the zenith without flipping, even though it is underneath and looking west, we refer to it as EAST OVER AXIS.
- If the scope is on top when aimed West (or underneath when looking East), then check the Below Axis box.
- If the scope will **not** flip when it crosses the meridian, leave the Flip box blank. If the scope **will** be flipped (automatically or manually) when crossing the meridian, check the Flip box. For example, if the scope flips when slewing and you plan to do so, then you would check Flip. However, if you plan to track past the meridian without the scope being flipped, then uncheck Flip box.
- Note that if the scope flips at the meridian and you have checked the box as you should, when the scope gets to the meridian and executes a flip (or you do it), the Over/Under box will automatically switch check marks, and the dome azimuth will change to accommodate the new scope location in the dome.
- If you are imaging a series, if you go past meridian and the scope flips differently from what you set on the flip box, you will discover that your subsequent images are of the inside of your dome! To recover, just click the actual scope position (over/under) so that the dome corrects its azimuth (and fix the flip box).

It is theoretically possible for the actual scope position (ie, East over/under axis) to be set correctly and yet the internal software may be applying the dome azimuth adjustment as though the opposite were true. To handle this, click the HELP button in the GEM box.

Park Scope/Stop Park/Unpark Buttons



These buttons send commands to an LX200 (if connected) to stop it from tracking, restart tracking, or to inhibit a DDW automatic Park command. See LX200 Adapter and Parking description below for details. When operated, you will hear five beeps for Park or three beeps for Unpark.

Training the DDW (“Train” button)

When you start DDW for the first time, it uses default values for the dome diameter, dome azimuth at HOME, shutter timing, and sensor calibrations. You must train the DDW to learn these values for your particular dome, and it will remember the new values even after being turned off. You can retrain at any time, but once trained, you should never need to do so again. You can always verify the current training values by using ShowData.

Azimuth Training. Use the hand control to rotate the dome so that the slot is true NORTH (not magnetic north). This is necessary so that DDW can learn where Home is relative to North. If you have a scope present in the dome, you can aim the scope North, and use it as a guide to align the dome shutter quite accurately.

Before you do anything else, use the ShowData button and review the information packet. You should see a series of data such as V4, AAA,BBB,CCC,DDD, etc. These are the default values left in the DDW after our testing. AAA is the circumference from your training, BBB is the home azimuth (CW from North), CCC is the coast distance, and DDD is the current azimuth, all measured in ticks (see App. 1). **Write down** the numbers! After training, the circumference should be in the hundreds to a few thousand (depends on your dome size and other factors)—if you have zero or a small number, you will know training was unsuccessful (see Troubleshooting table). The home should be at the right az CW from north. Coasting is usually 3-20. If training was not successful, then none of the azimuth commands (except HOME) will work properly. Note that you can reset DDW to internal default values using the on-board push button (see later in this chapter).

Now click on TRAIN. You will be asked whether you want to train the dome (azimuth) or the shutter.

When you select dome (azimuth) training, you will get an explanatory screen. If you proceed, the dome will rotate CW and will begin measuring the rotation amount (measured in “ticks” or steps of the movement sensor). As it passes HOME, DDW records the “tick” count. The dome continues to rotate all the way around to HOME again, when it records the “tick” count at each edge of home. It then backs up, to measure the trailing edge accurately. From these data, because the dome started at the North position, DDW computes the HOME azimuth, circumference of the dome, width of the contact plates, and amount of coasting to correct for in movement commands. These data are recorded in non-volatile memory in DDW for use in later sessions.

This completes the training operation. We strongly recommend that you again use ShowData to observe and write down training data (see App 1 for interpretation). Once the dome is trained, you can always look at Show Data to verify that the training data are still good. If the data remain valid, retraining the dome in response to operational problems is never a useful step. However, failure initially to train the DDW can result in confusing and apparently erratic behavior in the shutter position indicator, or in many of the rotation functions, including slave and GOTO functions. If you see such behavior AND the training data are way off, try training the dome, otherwise, the problem is elsewhere than training (see Troubleshooting table).

Shutter Training. When you select shutter training, you will get an explanatory screen. The shutter indication relies on timing the shutter movement, ie, unlike azimuth training, shutter training does not affect any shutter operation, only the display in DDWCP. If you select to train the shutter, the shutter movement shown by DDWCP will automatically calibrate

when you execute the next commanded shutter movement To do so, operate the shutter using the OPEN or CLOSE button on the DDWCP screen so that the shutter moves the full amount without stopping along the way. Shutter training data are not a part of the information packet.

Shutter Control (“Open” and “Close” buttons)

The shutter may be opened or closed by clicking on the proper button.

WARNING: because the shutter operates only in the HOME position, to close the shutter, an Open or Close command will first cause the dome to turn to home before the shutter operates. If a person is in the dome, always warn him/her before operating the shutter or rotation commands. After returning home, the shutter will begin opening (closing), and the schematic will show a moving shutter. The amount of movement shown on the screen is estimated by DDW from a self-calibration of time taken during the first shutter operation after training the dome.

Note that DDW assumes that the shutter has reached full open/closed when the shutter motor current drops to zero during a shutter operation. A power interruption or other problem giving a premature current drop can mimic open/close. In that case, the shutter will not be fully open/closed, even though the DDW reports that it is. For this reason, when the DDW believes that the shutter has reached an end point, it will attempt additional movements in the same direction to assure that it has in fact reached end of travel. The next shutter command will correct or verify the shutter data. If this level of shutter position reporting reliability is not sufficient for an application, DDW is not an appropriate system for your use: please call us for recommendations for a more sophisticated control system.

When DDW is turned on, it does not know the shutter status until an open/close command is executed. When DDWCP is then turned on, it will read the DDW data, and show the shutter and DSR status as undetermined. If DDWCP shows that these data are undetermined, you can send an open/close command, which will update the display (if the dome is already opened/closed, sending an open/close command will result in no movement, but will generate the desired data). Note that the DSR Interlock (discussed below) also functions only when the shutter has been operated to End of Travel (EOT).

This may sound complex, but in practice is not a problem. In practice, you will normally leave DDW turned on all the time. DDW will learn and remember the shutter status unless turned off. Thus, even if you turn DDWCP off, then on, you will see correct, current shutter data.

Slave Button

This button turns slaving on/off (the source of the slaving data (i.e., the telescope position) and other configuration data is set in the Configuration/Slave screen). You can turn slaving on/off with this button, or you can use B5 on the hand control (two quick presses turns on slaving, one or two turns it off). If slaving is turned on, and the DDWCP is not connected to DDW or if there is no scope data specified in the Configure screen, the DDW controller will default to attempt to use the LX200 Interrogation mode.

When the dome is slaved, the scope will generally move some distance before the DDW decides to move the dome. This dead zone is described below. If the scope is tracking slowly, the dome will usually move a few degrees every few minutes. If you slew the scope quickly to a very different part of the sky, the dome may follow a different behavior. In general, because the DDW only checks the scope direction every few seconds, there will be a brief delay before the dome starts to follow the scope. If the scope is moving fast and far in azimuth, the dome may not keep up. Thus, the dome will move some distance to match its first reading of the scope direction, stop, read the new current scope direction, and then move again. Thus, the dome may make several successive moves following the scope. In fact, if the scope is moving over the zenith, the dome may start in the “wrong” direction and then reverse to get to the correct azimuth. This is normal.

In most domes, the dead zone setting is the major factor that determines whether the dome will move in response to a given GOTO command (or LX200 interrogation). However, some non-TI domes have large coast values (determined at the time of training). If the coast is larger than the dead zone, then DDW will not execute the commanded GOTO unless the move is also greater than the coast distance (otherwise, the dome would overshoot the goal). To provide better slave tracking in this case, although DDW will not execute the full commanded move, it will “bump” the dome for 0.1 sec. each time it receives a GOTO command less than coast but greater than dead zone. This will nudge the dome toward the correct setting. If the coast is very large causing the bump to overshoot the mark, the bumps may cause the dome to bounce back and forth. If this occurs, increase the Dead Zone setting to stop the effect.

Configure Button

This button brings up a configuration screen, which gives access to several screens for the input of data to configure DDW for slaving and data communication. These data include

- Setting the source of telescope position information for use in slaving
- Describing the physical dimensions and type of the telescope mount for more accurate slaving
- Setting the serial communication port which the computer will use to talk to the DDW

These functions of the Configuration screen(s) will be discussed below.

RCA Options

DDW can obtain telescope pointing data from files generated from several different sources, or can obtain the information by interrogating the telescope (LX200 or compatible) directly. RCA or Remote Control Astronomy is our term for the use of a specific file name (SCOPE.DAT) and structure either to send direction data (RA and DEC) to DDW, or actually to send operating commands to DDW. The **RCA option** screen allows you to select this option which tells DDWCP that you intend to provide this file. Note that you still must set the ConfigureTelescopeSlaving menu to select actual use of RCA. We invite you to see the Appendix for information on structuring and using the RCA files as they are very easy to do!

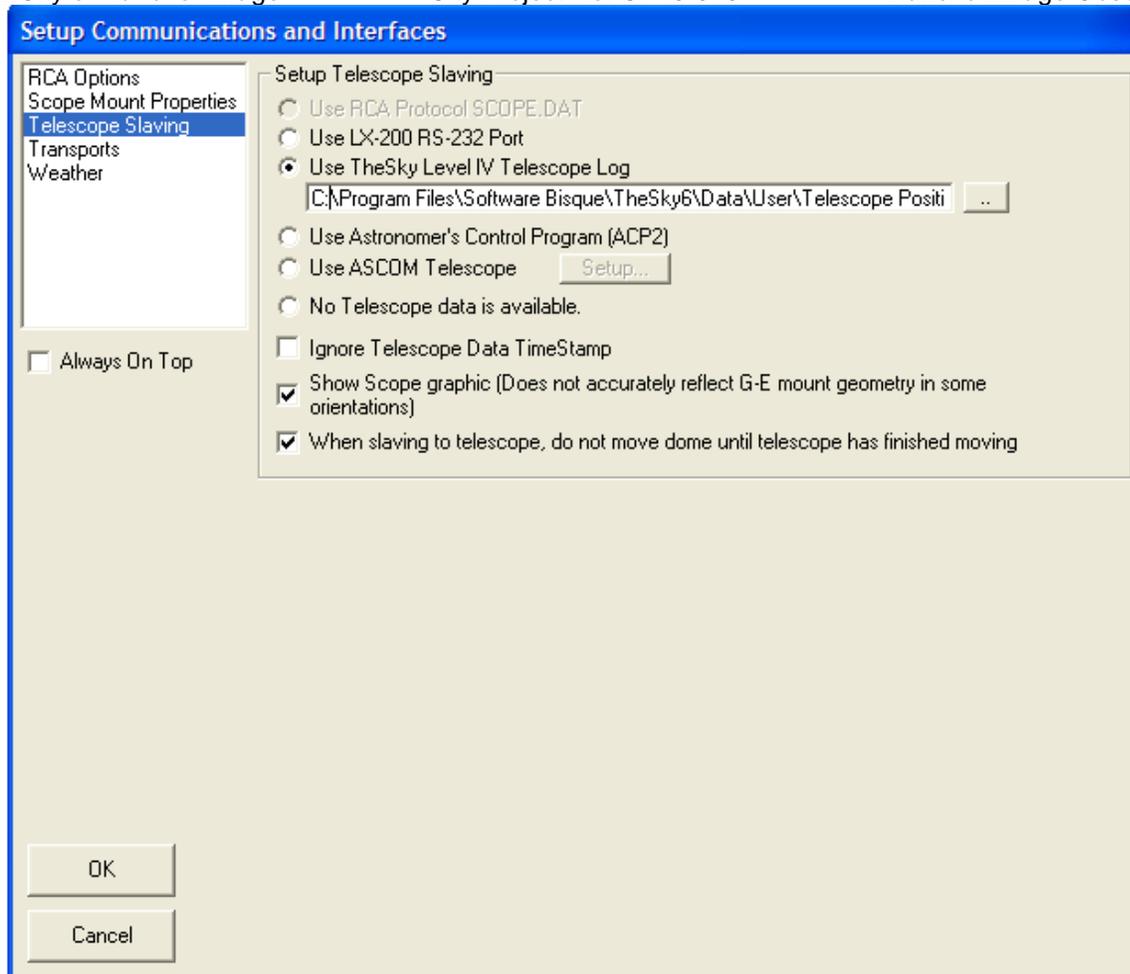
Telescope Slaving

Slave to Telescope

This set of options allows you to select the method to be used to slave the dome to the scope. Note that actually to turn the slaving on or off requires that you click on the slave box on the main screen, or use B5 on the hand control. Slaving is deactivated in DDW whenever the DDW is turned off, when a movement command is made (via the main screen or the hand control), when DDW loses communication with the DDWCP, or entering the Configuration screen. Slave function is turned off in DDWCP whenever you exit DDWCP. These cutoffs are built in so that there are no unexpected movements of the dome when DDWCP or DDW are turned on. Note that configuration settings are automatically saved when you exit DDWCP.

Configure Screen - Telescope Slaving

Choosing this option brings up a screen into which you can select telescope slaving options.



Note: The next chapter has more specific information on different scope control programs, and how to use them in slaving applications.

Use RCA Protocol. If RCA was selected above, then this will be a selectable option

Use LX-200 RS232 Port-This is the option that will direct the DDW to obtain its pointing information from the telescope (Interrogation mode). For purposes of discussion, we assume that the user will operate an LX200 (or equivalent control) telescope from software in the user computer. This requires an RS232 serial connection to the telescope. If you already have a working cable and connection for the scope, there is no need to change your system unless you plan to slave the dome to the scope using

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the Scope Interrogation mode (by which the DDW queries the scope to get its azimuth).

If you do plan to use the Interrogation mode, or if you have no existing scope control cable, you can use the LX200 adapter provided: in any case, in using the scope interrogation mode, do NOT intermix cables or adapters provided by Meade (or anyone else) with our components. Connect the PC to the scope via our PC1 and LX200 adapters. If you are using the Interrogation mode, connect the DDW to the LX200 Adapter. The LX200 Adapter allows to separate channels of information flow into and out of the LX200.

In this mode, DDW will sample and follow the scope direction about every four seconds. The revised dome position will be displayed by DDWCP whenever it performs a query to DDW. Note that the LX200 uses S=0deg rather than the standard N=0deg azimuth standard. Turn on SW6 on the DDW circuit board to make DDW automatically convert the LX200 Az reading when positioning the dome.

Use TheSky Version 6. TheSky, Version 6, writes a file containing the telescope pointing information. This is similar to, but not identical, to the SCOPE.DAT file we mentioned above. This button allows you to select TheSky6 as the data source, and to specify the path to the file.

Use the Astronomer's Control Panel. The ACP (also known as DC3) program is a general purpose LX200 control program. Selecting this button allows you to use the control panel as the telescope data source. When you press OK, (and when DDW is started in the future), the ACP program will be automatically started if it is not already

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running. To prevent a lengthy timeout, please ensure your telescope is on and ready

before the ACP is started.

No telescope data available. This is the alternative indicating that no source of data is available on the computer which can be used by DDW to calculate an azimuth position (slaving will not operate).

Ignore Telescope Data Time Stamp. When using the RCA SCOPE.DAT or TheSky Telescope position file, the DDWCP can monitor the file's last modified date/time to determine whether the program generating the data is offline. If the date/time of the file becomes more than several minutes old (relative to the local system time), DDWCP will turn off slave mode on the presumption that the program generating the telescope coordinates is offline. Checking the box disables this feature, allowing DDWCP to slave regardless of the file's age. We recommend that the box normally be checked so that long slaving sessions can operate without requiring new slave data updates. Please note this option has no effect on the LX-200 Aux Port and Astronomer's Control Panel selections.

Show Scope Graphic. When checked on, a telescope graphic is added to the main DDW display screen, positioned inside the dome graphic. Movement and position of the scope will be displayed along with the dome and shutter slot. (Does not accurately reflect GE mount geometry in some orientations).

When slaving to telescope, do not move dome until telescope has finished

moving. When checked on, this option allows DDW to calculate the shortest distance and correct direction when rotating to new scope position. This will prevent the rotation of nearly 360 degrees when a short slew involves a meridian flip. Note: if left in on position, it will cause an approximate 6 second delay in “normal” movement of the dome under slaving.

Always On Top Always On Top

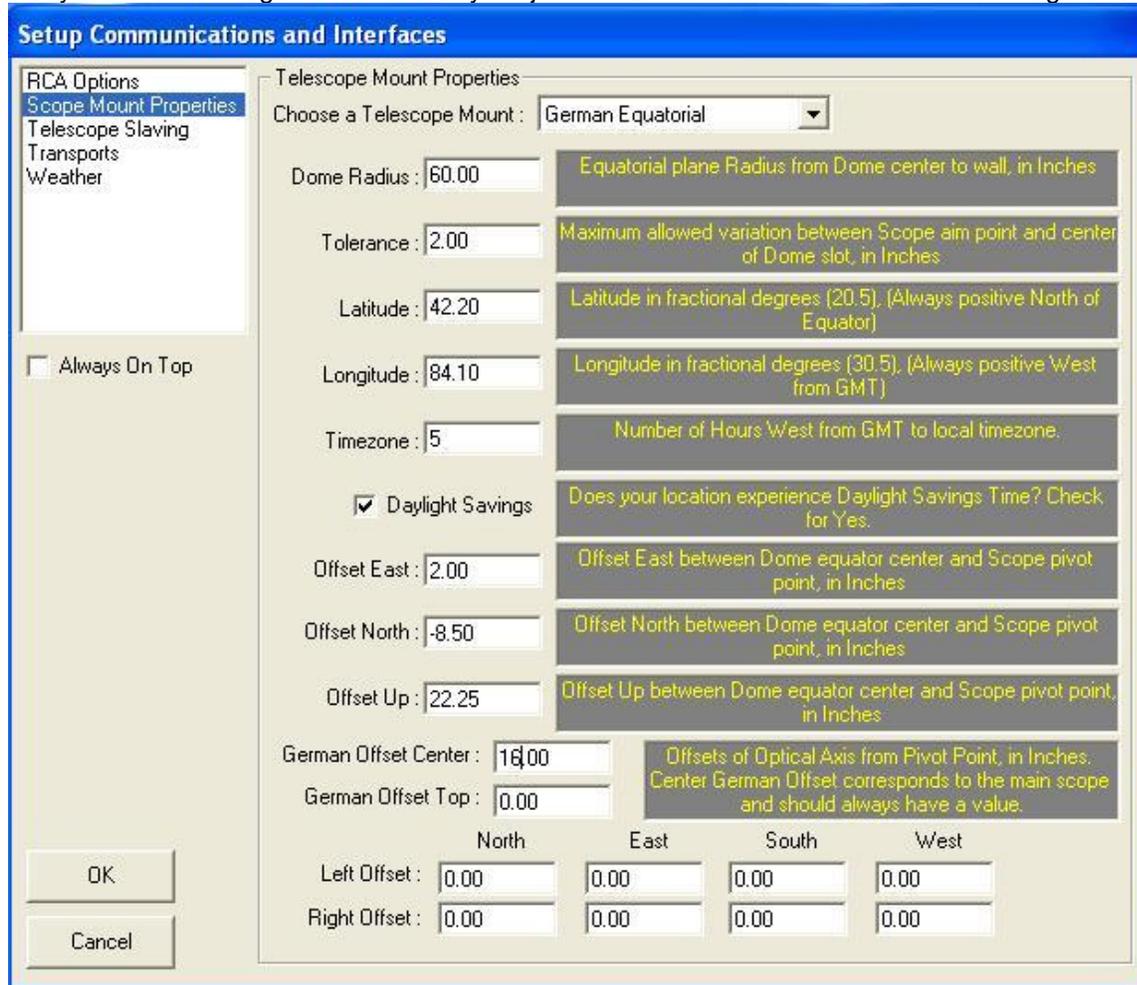
Placing a checkmark in this box will cause the DDWCP to stay on top of all other windows on the desktop.

Configure Screen - Scope Mount Properties

Choosing this option brings up a screen into which you can place data describing your telescope mount.

You can tell DDW whether you use a yoke or German Equatorial mounting (the LX200 uses a yoke mounting). The distinction is not important if your scope optical axis is always close to the center of the dome. However, if the scope axis is substantially off center (as is often the case for German Equatorials), then the dome azimuth must be offset from the scope azimuth to have the scope optical axis centered in the slot opening. If this is your case, enter your mount type and measurements into the Setup Scope Mount screen, so that DDW can automatically compute the proper offsets for your setup.

Note: the mount measurements are the position of the GEM pivot point (physical intersection of the polar axis and the declination axis) relative to the dome center of radius.



The items in the screen are as follows:

Dome Radius. Radius of the dome in inches

Tolerance. When slaving is on, the DDWCP continually uses the scope data (from the scope control program) to compute the scope centerline in space, and then taking all factors into consideration, computes the desirable dome azimuth. As the scope moves, its centerline moves across the slot opening. When the scope has moved so that the difference between the desired and actual (slot centerline) dome azimuth exceeds the “tolerance” value, a GOTO command is sent to DDW to move the dome. The value of the GOTO command is “inflated” to move the dome so that the centerline of the scope will be at the tolerance value toward the other side of the slot opening. Thus, the centerline of the scope will never be more than “tolerance” away from the slot centerline. In general, one sets the tolerance to a value large enough so that the dome moves only when necessary.

Note that the DDW circuit board has four switches used to set the Dead Zone (1-15 deg). This is a hardware setting that establishes a minimum amount of rotation before GOTO commands will be carried out. The dead zone is also set so that the dome does not move unnecessarily. An example will show how the settings interact. If the tolerance is set to 4 deg, and the Dead Zone to 7 deg., RCA will begin issuing azimuth commands when the desired-actual az error exceeds 4 deg. However, DDW will ignore these commands until the error reaches 7 deg (the larger of the two). The dome will then turn 7+4 deg. to the new setting.

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A simple setup that works for most situations is to set the tolerance to 0 deg, and set the DIP switches to 3 deg. For most domes of six feet or larger, this will keep the scope/slot error below about two degrees. Settings less than 2-3 deg. may result in dome oscillations (hunting). If you see hunting occur, simply increase the dead zone setting

Latitude. Enter your latitude, e.g., 40.3 or -20.3 (degrees)

Longitude. Enter your longitude west of Greenwich, e.g., 77.2 (degrees)

Time Zone. Enter your time zone west of Greenwich. For example, New York is TZ=5. (Due to a bug in the DDWCPV3, if you are on daylight saving time, subtract one hour from the TZ, ie, New York is TZ=4). Assuming your Windows is set to automatically adjust the system clock for daylight savings, the DDWCP program will always get the correct civil time for its calculations. If you use GMT on your computer, you should enter TZ=0

Daylight Savings. Enter Daylight Savings on/off as appropriate (some states/locations do not go to DST). Box needs only be checked once at setup. DDW will automatically adjust based upon the computer clock.

Offset East. This is the distance in inches that the pivot point is East of the center of the dome. If the offset is to the west, use negative numbers. Try to measure this to an accuracy of better than one inch for accurate slaving.

Offset North. This is the distance in inches that the pivot point is North of the center of the dome (South is negative).

Offset Up. This is the distance the pivot point is above the equatorial plane of the dome (below is negative). If the dome is not a hemisphere, do the measurement to the theoretical equatorial plane.

German Offset. This is the distance of the telescope optical axis from the mount pivot point. This is always positive. If two instruments are being used (one on top of the other), measure the distance for each and enter in the appropriate field. If several instruments are being used, you can measure to the center of the theoretical circle that would enclose the array.

Left Offset. If two scopes are mounted side-by-side, one centered and the other to the left, a complete set of offset values, (always positive numbers), can be entered for the scope to the left. This will provide data for the appropriate corrections when the "left" scope is selected on the main DDW screen. The best approach is to apply an arbitrary value (try 20 to start), then adjust with a few trial runs.

Right Offset. If two scopes are mounted side-by-side, one centered and the other to the right, a complete set of offset values, (again only positive numbers) can be entered for the scope to the right. Follow the same procedure as discussed in "Left Offset" above. This will provide data for the appropriate corrections when the "right" scope is selected on the main DDW screen. A total of four scopes can be independently configured and selected as the instrument in use.

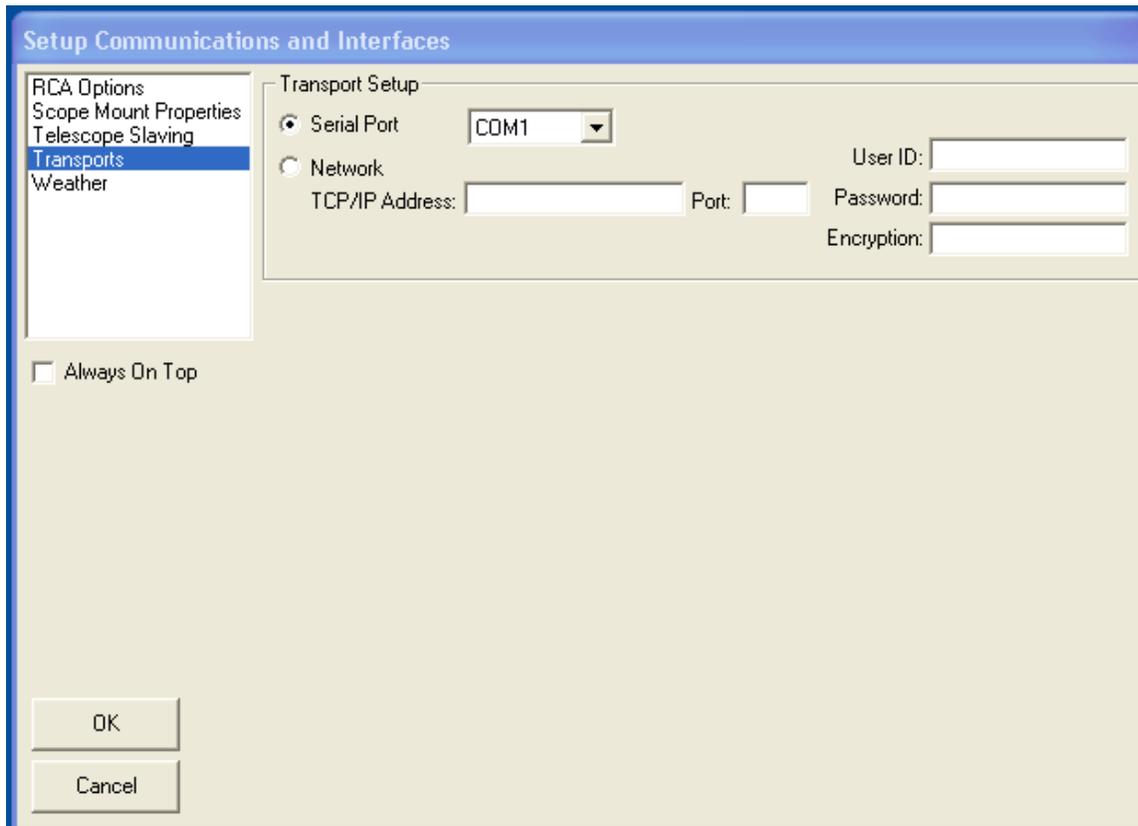
There is one final "complication". Many users will operate DDW using LX200 interrogation (without the RCA protocol enabled). In that case, the RCA settings, including the tolerance, will not be used in generating dome movement commands because they are being generated within the DDW processor directly. The dead Zone setting of the DDW will then establish the size of the error before movement occurs. To allow the same type of control that "tolerance" provides, the DDW board has a switch that enables auto-offset so that the DDW treats the Dead Zone just as it would tolerance moving the scope past the center of the slot opening. The Auto Offset switch should be OFF when RCA is used, or else the value of the dead zone will be added to the tolerance when moving the dome.

For further discussion, see the section of "Advanced Remote Control" below.

Configuration Screen – Transports

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Choosing this option brings up the screen allowing the communications connection options, (Serial Communications Port).

The user PC that is running DDWCP communicates with the DDW in the dome using an RS232 serial communications cable. The user must tell the DDWCP the number of the communications port on the PC that is connected to the DDW. These ports are usually referred to as COM1, COM2, etc. If you need information on serial ports, please refer to the Appendix.



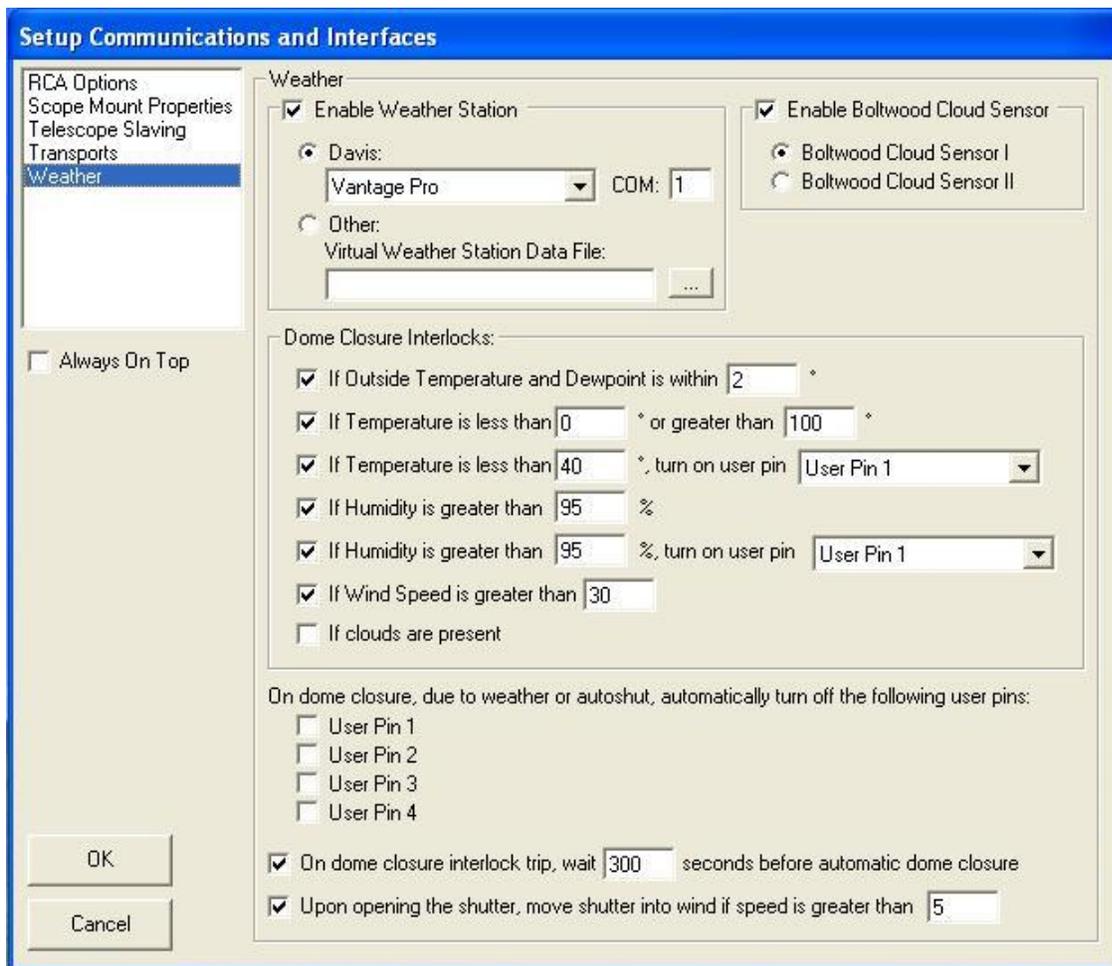
The Configuration screen provides the method of assigning the communication port. Assuming use of the RS232 line, you will normally select “serial port” for the source of the control data, and then select the COM port to be used. If the COM ports are not numbered on back of the computer, simply select COM1 (or COM2, etc.) and hit ENTER. Assuming DDW in on in either LOCAL or REMOTE modes, DDWCP will attempt to connect to the DDW. If successful, DDWCP will show a completed connection. If not, try another COM port (normally COM1-4 are present, with one or more in use by the modem, mouse, or other devices. When using a USB to Serial adapter (most if not all work very well with DDW), try COM4 or COM5 first as XP and Vista normally attempt assignment at that level.

If you are unable to make the connection, please refer to the Appendix for troubleshooting suggestions.

Network. The Configuration screen allows you to operate the user computer from yet another computer over a network or the Internet. See the Appendix for details on this operation.

Configuration Screen - Weather

If you have purchased the (optional) weather station package, and/or the cloud detection system, this screen is used to interface that equipment with the DDWCP. The weather station will monitor weather events such as the wind velocity and direction, temperature, humidity, and the presence of rain. The complete instructions for the set up and operation of the weather station configuration screen are included in the optional weather station package. If you did not purchase your weather station from Technical Innovations contact us for a copy of these instructions.



The screen has interlock settings that allow the DDWCP to monitor the weather data and to close the observatory accordingly. For example, you might set the interlock for a wind velocity of 30 mph. If the wind exceeds this amount, the DDWCP will issue a command to close the shutter. This results in a buzzer warning in the dome, and closure after about four minutes. If you wish to cancel the closure command, push AllStop (either on the screen or on the hand control). A

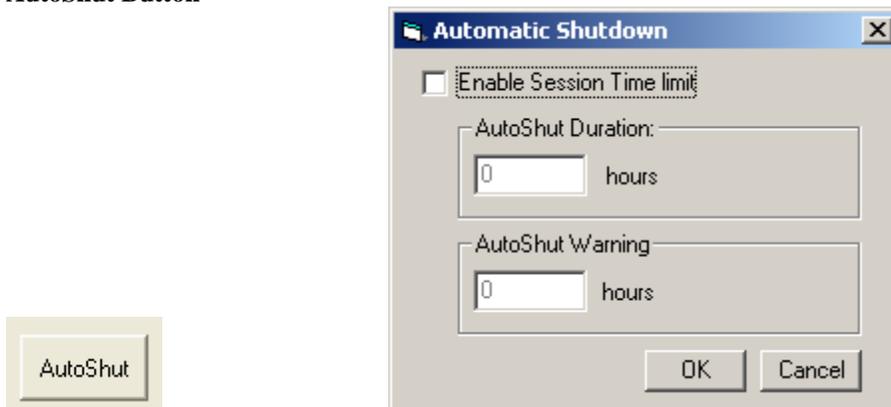
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repeated weather violation will produce another command. To stop commands altogether, turn off the interlock on the weather screen. Note that the interlock is exercised after DDWCP receives data from DDW. If the dome has been opened manually and the DDWCP is not operating, the weather interlocks do not function.

Check boxes allow the identification of User Pins (Remote Power Module circuits) that will be shut off automatically upon dome closure. The optional weather stations do not have to be installed and active for this option to work, (for example timeout closure from the AutoShut timer).

The dome closure delay feature will place a user set (in seconds) delay between a weather interlock detection and the actual closure of the dome. This provides the opportunity for an interlock to clear before actually closing the dome. Rain detection will still close the dome immediately upon detection and is not subject to this override pause.

If a wind is detected upon startup of DDW (user defined wind speed level), the dome can be automatically instructed to rotate to the point where the shutter opening will be facing the wind immediately after opening. This feature is very useful in cooling down the inside of the dome at the start of a viewing session. This option can be turned on/off as desired.

AutoShut Button



The AutoShut button opens a timer box that will execute a shutdown of the observatory after a predetermined (and user entered), time passes since DDWCP was opened or the AutoShut was reset. The purpose of this is to close the observatory if you have forgotten to shut off the DDWCP. We normally recommend a setting of, say, 6 hours. You can always reset this during a session. See the discussion on Interlocks (below) for details.

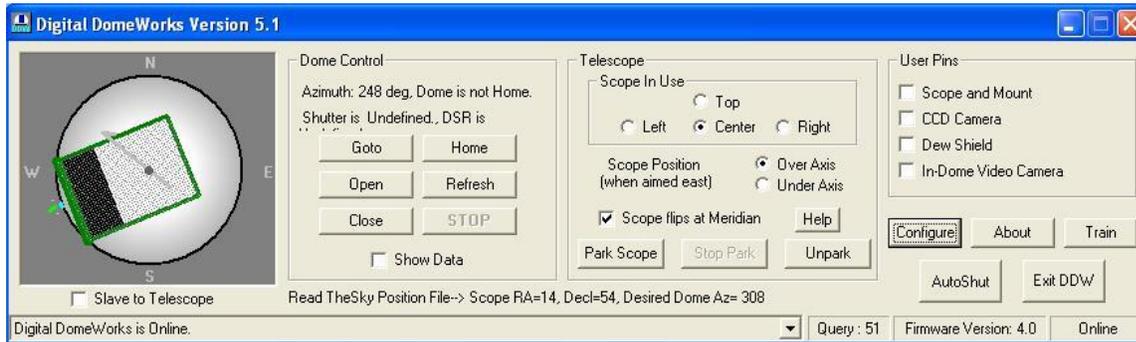
User Pins



The User Pins button brings up a small screen giving access to the four output control lines of the DDW. If you click on one of the boxes, the DDW will turn on the transistor (in a chip to the left of the main processor) connected to the respective wire. The transistor will stay turned on until it is switched off, or until the DDW power is shut off (closing the DDWCP connection does NOT turn off the output transistor). The output transistor is capable of sinking about 100 ma from about 25v source.

The most common use of these lines is to operate a remote power module that includes four relays that turn 120VAC power on/off to four outlets. However, you can use the control lines for other purposes as well. This screen comes up automatically when you close DDWCP to help you remember to turn equipment off at the end of a session.

Note that you can change the labels on the control lines using the right button of your mouse. Once you click on the description line, it can be “permanently” changed to reflect your use. See example below:



Log File

Log File (not a button) is an automatic log of the commands sent from the DDWCP to the DDW and the received data. This log is very useful when you are diagnosing problems or otherwise interested in the history of the operation. The log is in simple ASCII format, and includes the date, time, movement commands, and response of the DDW. To save file space, only the first repeated GETINFO commands and the number of repetitions are recorded. You may inspect the entire file using NOTEPAD or other text program.

DDW will create up to ten files named DWLOGX in the DDW subdirectory. The file DDWLOG0 is the newest and DDWLOG9 is the oldest. Each is about 250K. DDWCP automatically deletes the oldest data and shifts data into higher number files. Note that the log files are NOT protected against changes, either inadvertent or purposeful. If some type of adverse event occurs, it is desirable to copy the log into another file for safekeeping.

Interlocks / Troubleshooting

DDW supports a variety of hardware and software interlocks and special operations to protect the observatory and personnel. Many cases of apparent operating problems are really cases of the interlocks operating as designed, but not fully understood by the user.

Rotation Motion Sensor and Interlock

The azimuth sensor is used to track rotational movement of the dome. Besides its use in determining azimuth, the motor control software requires that the sensor show that movement is actually occurring. If not, the motor is shut off in about two seconds. This is designed to prevent a jammed dome or other problem from destroying the motor drives. If you lower the sensor so that it does not function and try to turn the dome with the hand control, you can see this interlock in action (the motor will pulse on/off every few seconds). Anything that prevents the Az sensor signal from getting into the DDW will cause the rotation function to fail. There is no direct motion sensor on the shutter in DDW.

Motor Current Sensor and Interlock

During shutter movement, the DDW monitors the shutter motor current. When the current drops below a cutoff level (usually because the shutter reached the end of motion and the shutter relay cut off the motor), the DDW will shut off the

power to the shutter. During shutter operation, software requires at least five seconds of electric current before current cessation is presumed to be a full open/close. Thus, to get correct indication of an almost open shutter, you must run it for at least five seconds toward closed, then open it fully. An already fully open/closed shutter will show its position without actual movement.

Motor Duration Watchdog

The DDW control chip also provides a “watchdog” function on the motors. That is, if either the shutter or rotation motors operates (as detected by motor current) for more than about 250 seconds, the watchdog will cancel the movement command, thus shutting off the motors. The purpose is to prevent a mechanical failure (e.g., loose sliding contacts that cause the DDW never to find Home) from operating the motors for long periods. If you are operating remotely and the watchdog operates, you will see the DDW simply stop what it was doing.

There is a second 10 minute motion timer built into the Electronic Speed Control (ESC) chip. This will limit motion if there is a fault in hand control related devices that would not be stopped by the DDW chip.

DSR Swingout Interlock

This interlock works when the dome is in the Home Position and the DDW is about to execute movement. It does NOT operate when using the manual rotation control buttons on the hand control.

Many Home-Dome/Pro-Dome observatories allow external entry using a hinged portion of the dome support ring called the DSR Swingout. The Swingout is normally latched during use of the dome. If the Swingout is unlatched when rotation begins, the dome may expand and partially fall around the wall, possibly causing personal or equipment damage. To help prevent this, whenever the dome is to be rotated away from the HOME position, DDW first checks whether the Swingout is closed by reading a magnetic sensor on the DSR (the magnet is on the Swingout). If the Swingout is open, the dome will not rotate away from home.

Note: this system is NOT foolproof. For example, if the Swingout is closed, but not latched, rotation may start and the dome may begin expanding. Therefore, the best policy is always to Close and Lock the Swingout, as recommended in the observatory instructions.

If your observatory does not have a Swingout, simply leave the DSR Interlock wires connected to terminals in the shutter relay (or install a shorting wire), and do not install the interlock magnet and sensor. The DSR Interlock terminals on the shutter relay MUST have the interlock or a short as the DDW uses this wiring to detect the Home position.

Communication Cutoff Shutdown Interlock

DDWCP normally queries DDW processor every 100 seconds to get the dome status (time to the next query is shown on the DDWCP screen). If no reply is received after several tries, DDWCP declares DDW off line and the schematic on the screen goes dark. Meanwhile, DDWCP continues to try to connect every 100 seconds, and if communication is re-established within eight minutes (four minutes in older DDW), the schematic will come back on. If the screen schematic does not re-appear after eight minutes, the dome will close itself (assuming power is on in the observatory). A common cause of this behavior is that you turned off the control computer or closed DDWCP without closing the dome first.

In the observatory, the DDW processor looks for queries from the DDW Control Program. If it receives none in eight minutes, DDW will interpret that as a communication failure, and will rotate the dome to HOME, close the shutter, and turn off the SLAVE function. Before this closure takes place, there is an audible warning given by the buzzer. Four minutes after

the dome is HOME and the shutter closed, a park command will be sent to an attached LX-200. During the eight minute timeout, any hand control command will restart the timer from zero. Note that this interlock also functions to close the dome if the dome was open when power failed—upon return of power, the DDW will time for four minutes and then close the dome automatically. Warning: the DDWCP queries can be blocked if the computer is tied up 100% on another program for more than four minutes, for example, by fast sequences of images and long downloads. The solution is to introduce breaks (delays) in the operations (or change program priorities) so that the DDWCP can get its queries to the DDW.

If you are in the observatory and hear this audible signal, it is warning you that motion may take place. If this will cause a problem, you have time to shutoff the DDW using the switch on its front, or reset the timer back to zero with the hand control (eg, B5). If you are about to use the power supply switches for operations, you should wait until the closing sequence is complete. After the initial attempt, DDW will try up to five more times to try to close the dome, and you may hear relays click but no motion will occur.

AutoShut - Timed Shutdown Interlock

If you leave DDWCP running (and connected to DDW) with the observatory open, the observatory will stay open indefinitely (as it should). This can happen by accident if you forget to shutdown at the end of an observing session. It can also happen if you are using DDW at long distance (e.g., using the Internet) and shut off (or sign off or become disconnected) your user computer. This leaves the DDWCP program in the observatory computer still running. The DDW has no way of knowing that you have “gone away”, and so will NOT close the dome.

To counter this potential problem, the DDWCP has an AutoShut function button. When you turn on DDWCP, it begins with an expected duration for an observing session. When the time runs out, the button turns RED, the DDW minimized icon will blink, and DDWCP begins a final countdown sequence at the conclusion of which DDWCP rotates the dome to home, closes the shutter, and optionally parks the telescope.

The user may reset the AutoShut at any time by clicking on it. You can enable/disable this feature and set the session length/countdown duration by clicking on AutoShut and entering your desired settings. We recommend a typical setting of six hours or whatever is more than the expected session duration.

Note that this AutoShut function should not be confused with the communication timeout shutdown. AutoShut operates within DDWCP and closes the dome at the end of a pre-determined time. In contrast, the communication failure interlock in the DDW processor closes the dome whenever it loses contact with DDWCP.

Although you can bypass this protection, we strongly urge that you use it. It is amazingly easy to forget about an ongoing session or have some other problem that prevents a timely observatory closure. For example, in a long distance remote control application, you might turn off your communication program (PCAnywhere) leaving the DDWCP running on the user computer. The dome and scope might continue to operate indefinitely, damaging themselves in the process. Autosht would stop the operation after several hours. On the bottom of the weather configuration window, the DDWCP allow user pins to be turned off when an AutoShut of the dome takes place. By placing a checkmark in the checkbox of a user pin, that pin will be turned off after the AutoShut command is completed. You do not need to enable the weather window for this function to work properly. The weather enable box should only be checked if you have the optional weather station installed.

LX200 Adapter and Parking

Many persons use the LX200 telescope or other scopes that use the LX200 command set and connection designs. To make remote use of these scopes easier, DDW includes an LX200 Adapter. If you want to use any of the LX200 features of the DDW (slaving to the LX200, anti-wrap, and parking), you will use the Adapter to connect the LX200 to both your PC and the DDW as discussed above, and as shown in the diagrams.

The LX200 Adapter includes four two color LEDs that show the signal status of the four lines (to and from the PC, and to and from the DDW). Normally, all four lights should be green, showing that the connections are made and that the com ports

are alive (though not necessarily correct inside the PC). When a signal is sent down a wire (e.g., when the PC sends a scope slew command to the LX200), its LED will flicker red. Watch carefully—it is very quick, and therefore faint. The LX200 will respond with a similar brief red flicker. By observing these LEDs, you can tell when you have a proper COM port selected, whether commands are being sent, etc. Take a moment to observe these LEDs when the system is working, so that you can recognize incorrect operation if it should happen.

In polar or A-A tracking mode, the LX200 will track forever, and will wrap its wires around itself. This can damage the scope, as well as connected equipment. It is amazingly easy to forget to turn off a remotely controlled scope, so this problem is not trivial. Wrapping the wires may be prevented by

- **Turn off the scope in any position.** This works, but requires a trip to the dome and a new alignment process when turned back on.
- **Turn off the scope in its default position.** When you turn ON the LX200, it will come up with a particular RA and Dec where it thinks it is. If you send the scope to this RA and Dec at the end of your session and then turn the power off the scope, when you turn the power back on, the scope will know where it is (and will start tracking). This works, but does require remembering to move the scope to the default position. Depending on your equipment, reaching this default position may not be feasible—check your setup before using this feature!.
- **Change the scope mode.** Change the scope mode to “LAND” which turns off tracking. When you are ready to use the scope again, switch back to “POLAR”. Because the scope remembers the Sidereal Time, its alignment will still be very good. An alternative is to change the rate to the negative of the normal tracking so that the scope will “stand still” relative to the earth. The former step requires that you use the hand control in the dome, while the second alternative is supported by most scope control software, so may be done remotely. Either requires that you remember to do it at the end of your operating session. Power must remain ON even when not using the scope.
- **Use DDW Parking Function.** The DDW provides both manual and automatic “Park” commands that cause the scope to stop tracking

The DDWCP includes a manual control button called “PARK”. When clicked, this button sends a succession of commands to the telescope (via the DDW connection) that changes the guide rate to minus the sidereal rate—in other words, the scope will stop moving. This can be verified by observing the RA/DEC on the hand control (which will start changing as the sky moves past) or by the AltAz on the hand control (will now show a steady reading). While parked in this mode (even for days), the power must remain ON the telescope (does not hurt the scope). To restart tracking, send an UNPARK command from DDW. A GOTO command to the scope via the hand control will restart tracking, but a GOTO from external scope control software will not.

When DDW sends a Park command, you will hear five short beeps. An Unpark command will generate 3 short beeps.

DDW also has two *automatic* Park functions. When the DDW closes the dome (either by command or because the communication connection was lost and DDW is closing the dome by itself), DDW begins an eight minute Park timeout. At the end of the 8 minutes, DDW sends the Park command to the scope (assuming this is activated on the DDW board SW8). Thus, if you forget to turn off the scope, or even forget to close the dome (but do turn off the computer or exit DDWCP), your scope is protected.

Note that the DDW only issues the Park command one time, after every shutter closure. This allows you to operate scope tracking in a closed dome (e.g., for testing) without having the scope tracking continually turning off; however, you do then have to remember to Park the scope when you leave. If for some reason you want to disable the Park command during the timeout but before the command is actually sent, you can click the “Disable Park” command on the DDWCP screen.

The second automatic Park functions after a power outage. If power to the dome is lost, then restored, the LX200 will begin tracking when it powers up. To prevent wire wrap, DDW will automatically send a Park command four minutes after power up. If during the four minutes any command or query is received by DDW (from the buttons or from DDWCP), DDW assumes a human is involved and it cancels the Park command transmission.

DDWV4 includes a capability of detecting and correcting a computer crash. For example, if you are operating remotely and the In-dome computer should crash, the programs lock up. You can't reboot the computer because you are not there, and your remote control program (eg, PCAnywhere) is also locked. DDW will detect the crash because the communication keep alive every 100 seconds will not appear. DDW will shut the dome after 8 minutes, AND will generate a 2 second signal that can be used to operate a relay to reboot the computer (usually using a power off reboot). Please call for details. The Windows XP OS can also be configured to restart a computer if it crashes. Please refer to the Windows XP documentation to configure this option.

DDW Circuit Board Switches and LEDs

The DDW circuit board has several different switches that set particular configuration items or allow local control of some functions. We discuss these options in this section. Use the diagram in the DDW cabinet to guide you in identifying the proper components.

Local/Off/Remote Switch. The functions of this switch have been discussed above.

Circuit Breaker

The DDW board has a small circuit breaker at the lower right. This breaker controls all current into the DDW EXCEPT the high current through the relays to the motors. The small red window shows that the breaker is ON. When the breaker trips, its button moves to the OFF, or black position. You should use the circuit breaker if you want to turn the DDW power entirely off (including the hand control).

Default/TRAIN Button. This button has two functions. If this button (labeled on the board) is pushed and held while the DDW is turned on, the DDW will reset to its factory default values for dome diameter, home position, etc. This will wipe out all training values and settings made. It does not affect configuration settings made in DDWCP.

If the button is pushed AFTER the DDW is turned on, DDW will promptly start the azimuth training process (just as if you clicked on TRAIN in the DDWCP). The purpose is to allow the person in the dome to train the dome, if desired.

All Stop LED. This small lamp will glow when the ALL STOP hard wired interlock is active and when DDW is set to LOCAL.

HB light. The heartbeat LED tells you the DDW processor is on, and shows several different DDW conditions (great for quick diagnostics):

- If the LED is dark, the power is probably off
- The LED will blink about 1/sec (like a HeartBeat) when the DDW processor program is running properly.
- When the dome is away from HOME, the LED will be off, except for brief ON blinks
- When the dome is HOME and the shutter is open or indeterminate, the LED will be on, except for brief OFF blinks
- When the dome is home and the shutter closed, the LED will be steady bright with very brief off blinks
- If the LED is steady with no flicker or blink, the processor is likely faulty or requires restarting (turn DDW off, then on).

PC In and Out LEDs. The PC Board has two LEDs close to the PC input jack. One LED shows the voltage status of the incoming line, and one the outgoing line. The lights should normally be green, indicating +12v nominal RS232 voltage. When data are coming in/out, the respective LED will change to red color. Because the data are fast, this will be fast and faint, but recognizable when it happens. Failure to obtain the proper colors helps diagnose connection problems.

SW1-4. This set of switches is used to set the Dead Zone for DDW (this is not remotely settable). Dead Zone is the range (plus and minus) of the maximum allowed difference (during slaving) between the desired and actual dome azimuth. The switches set the dead zone at a value from 1-15 degrees. In general, a value of about 5 degrees (five inches on a ten foot dome) is a good value. Too small a value may cause the rotation control system to “hunt” or oscillate back and forth past the correct setting. If Remote Control Astronomy is in use, you may want to set the Dead Zone to zero and let Tolerance (in the RCA Configuration) determine the deadzone and offset operation.

The switches are set in binary code. All off=0, SW1 on =1, SW1 and SW2 on = 3, SW3 on =4, etc.

SW5-8. This series of switches sets several configurations in DDW.

SW5 Offset. Offset is whether the center of the dome slot will move past the center line of the scope when a dome azimuth correction is made. Use of the offset keeps the scope centered more closely in the slot opening. The switch turns automatic Offset On/Off. To avoid dome oscillation (hunting), the offset is internally equal to 3/4 of the dead zone. This switch should normally be ON.

SW6 LX Azimuth. Older LX200 “classics” (incorrectly) measures azimuth starting in the south. When ON, this switch automatically corrects all readings taken from the LX200 for this error. If a scope that uses the LX200 command set but with the correct azimuth is used, turn this switch OFF.

SW7 Az Sensor. An AZ sensor may have either one or two internal sensors. The one sensor model simply detects motion, while the two sensor model detects both motion and direction. The standard DDW includes the two-sensor azimuth detector, normally operated with SW7 OFF (the RoboDome uses a single sensor azimuth detector with SW7 ON). When using SW7 ON, user must allow about three seconds between rotation commands to allow motion to stop.

SW8 AutoPark. If this switch is ON, the DDW will automatically send park commands to the LX200 (if connected) four minutes after the shutter is closed, thus preventing the scope from wrapping. Reactivation of the scope can be done by and scope GOTO command, or by sending the Unpark command from DDWCP.

Electronic Speed Control (ESC)

The lower right hand corner of the DDW board contains the circuitry for the electronic speed control. The hand control or DDW processor operate the relays that direct and reverse the drive power to the rotation or shutter motors. The ESC delays the drive power until the relays have moved, and then turns the drive on. The drive is a variable pulse width modulated system. Adjustable controls allow the user to control the initial voltage (0-100%), the time to ramp up (5-0 sec), and the final voltage (0-100%) to be applied to the motors. Recommended settings are 25%, 75%, and 100% CW settings of the controls. This system also offers a special real time fast rotation motor speed control mode (see Appendix and Ch. 4). Finally, the ESC chip includes a 10 minute timeout that will cut off motors after ten minutes of operation. There is no indicator of this action, and it is reset by turning the power off/on.

DDW Terminal Strip

GND. This terminal is the system ground. Connect the (-) of the power supply to this point.

+12V. This terminal is the system power input. Power is nominally +12V DC. This can be unfiltered, filtered, or regulated between 12V and 16V. Current requirement for DDW itself is about 500 ma, plus whatever is required by the motors connected to the rotation and shutter terminals (typically 5-10A). Input power is wired directly to the motor drive relay circuitry. Input power also goes through the 0.5A circuit breaker on the board, then through the ALL STOP switch (see below) to serve the electronic speed control (and hand control buttons) and the LOCAL/REMOTE switch.

SW1 & SW2. The normally closed ALL STOP switch on the front panel connects across these two terminals. Input 12V power flows directly to the motor drive control. SW1 is connected directly to +12V. After passing through the ALL STOP switch, +12V back into SW2 feeds the electronic speed control, DDW processor, and DDW motor control.

ROTation. These terminals feed +/-12V high current to the rotation motors.

SHUtter. These terminals feed +/- high current through the sliding contacts to the shutter motor. The terminals also are used to detect home, the DSR interlock status, and supply charging current to the wireless weather monitor (if installed)

SHUTDOWN. In Remote mode, a connection to ground will cause the DDW to initiate immediate shutdown (go home and close). Only the connection transition is sensed: continued closure is ignored, and other commands may be executed.

UNIV INPUT. In Remote mode, a connection to ground will cause the DDW to react as if B5 were pushed (this terminal is in parallel with B5). If the connection to ground remains, B5 and the entry switch are inhibited. Only the connection transition is sensed: continued closure is ignored, and other commands may be executed.

ALL STOP. In Remote mode, a connection to ground will cause the DDW immediately to stop any DDW initiated motion. Manual operation of the four hand control buttons will not stop. Once this circuit is closed, the observatory cannot be operated and all commands are ignored until this connection is opened.

SLAVE. In Remote mode, pulling the terminal low for about one second will cause DDW to slave/unslave to the telescope. If DDWCP is not online, the slaving will operated in the interrogation mode on an LX200 telescope. If DDWCP is online, slaving will be in the mode selected in the DDWCP configuration screens.

DDW Trouble -Shooting Guide

(Note EOT means End of Travel)

Problem	Cause	Cure
General Problems in Operation	Error in connections Use of improper or faulty connecting cables Wrong serial port settings Error in configuration settings Remote/Local switch set incorrectly	Review in detail the Instruction Manual for all related parts of system. Isolate problem area. Substitute different cables. Write down behaviors. Use ShowData and Test buttons to get diagnostic info
Hand Control won't work at all	Not plugged in or in wrong connector No power to DDW unit DDW not turned on (check pilot light inside, front panel interlock switch) All Stop or external B5 switch activated On-Board circuit breaker tripped	Install properly Turn on power Deactivate All Stop Reset breaker
Hand Control four buttons work but not B5 DDW won't respond to computer commands Hand control pilot light blinks	DDW in Local mode or All Stop activated. Entry Switch turned on, blocking B5. System is operating as designed	Change mode, remove All Stop
Hand control pilot light is off	DDW off Entry switch in ON position (shorts out B5)	Turn on DDW Always turn entry switch OFF after commanding DDW action
Computer won't connect to DDW (check RS232 LEDs, use ShowData to check returned data)	Incorrect COM port on computer RS232 cable not connected or faulty Corrupted DDWCP files	Change COM port or reset via Configuration. Check cables. Reload DDWCP into PC (call TI)
Erratic Operations in rotation	DDW not trained Intermittent HOME or AZ sensor	Train DDW Test/observe. (call TI)
Remote motion commands show "operation complete" but nothing is actually happening	Local/Remote switch on Local. Note that DDWCP will still get info for screen	Change to Remote setting
DDW dome won't track scope	Incorrect Configuration settings Not trained Cables not connected properly Scope software does not support slave Intermittent HOME or AZ sensor	Fix configuration Train DDW Connect properly/recheck instructions Call TI Test/observe (call TI)
Rotation motors pulse on/off about once/sec	AZ sensor faulty or not connected Dip Sw 7 set incorrectly	Check connections, substitute a different cable, review settings
Rotation or Shutter motor operates about one sec and shuts down	AZ sensor faulty. Current Sensing circuit (shutter) faulty Dip Sw 7 set improperly	Check AZ sensor & cable. Check for current signal (app. 0.5v) Check setting
Shutter won't go either way using hand control	Dome not in Home position	Return Home. Note in Remote computer control, DDW does move home as part of shutter ops
Dome will not rotate away from home	DSR open so interlock prevents operation in Remote mode	Close and lock DSR Swingout before operating DDW in Local mode
DSR Interlock does not function when you test it	DSR Interlock only functions when shutter has been run to EOT.	To assure DSR Interlocking, always run shutter to EOT.
Dome does not immediately follow scope	Scope movement less than DeadZone or tolerance DDW takes up to 8 sec to respond to scope	Review operating theory
Shutter CLOSE/OPEN sometimes does not give proper shutter condition data	If shutter is near (but not at) end of travel, the minimum travel time may not be satisfied and EOT data are not taken as final (this prevents a glitch causing a premature shutter stop from giving inaccurate data) If reconnecting DDWCP to open dome DDW cannot know shutter position until a shutter command is sent	Send another CLOSE or OPEN which should give proper data
Rotation erratic in operation or shows incorrect azimuth GOTO commands leave dome at incorrect azimuth	DDW may need to be trained, check ShowData DDW is adding auto-offset (equal to dead zone) to Goto azimuth LX200 Az correction sense switch incorrectly set	Train DDW If not desired, turn off auto offset on DDW PC Board Review instructions for setting
Rotation shows incorrect azimuth/shutter shows incorrect position	Although training data are held when DDW turned off, current position data are lost	Return to home and operate shutter to update data
When initially connecting shows "Can't open port", no "TCP/IP connection" or similar item	Wrong port or wrong mode chosen in configuration	Select Config and try different settings (see instructions)
DDW appears to reset itself when performing rotation or shutter ops	DDW motor watchdog resets if motion lasts more than 8 minutes	Review operating theory..

Dome rotates but will not stop at Home	Circuit through shutter wiring is open. Requires DSR Interlock, shutter relay, and shutter motor to be connected.	Check connections, contact slider cleanliness. Check heartbeat indicator light on DDW board.
Dome turns or closes when I don't want it to	Communication timeout triggers Home/Close when DDWCP is turned off or queries are interrupted Autostop (Session duration) or other interlock operating	Leave DDWCP on, switch to Local, or activate AllStop to prevent motion
Slaving sort of works, but not accurate	See above incorrect azimuth problems LX200 Az correction incorrect Ger Eq direction incorrect Config mount settings incorrect	Review Instructions. Review mini-help screen in GEM settings.
DDW won't find Home	May have DSR I/L board or Shutter Relay disconnected from sliding contacts or improperly mounted Dirty or poor sliding contacts, bad connection	Correct problem. Note DDW will not find home unless DSR I/L and Shutter Relay properly installed
DDW won't park scope	May have SW8 on DDW board incorrect.	Make correct setting.
Slaved dome makes several movements when following the scope	Operating as designed. DDW computes a new target every few seconds as scope moves, so large scope movements may cause several dome movements.	Review Instructions
Slaved dome bounces back and forth around correct position	Dead zone set too small for dome coasting characteristics	Increase dead zone setting.
Opened the dome with entry switch, but it did not close itself	Operating as designed	Automatic closures depend on DDWCP being activated. Manually opened dome will remain open until manually closed.
Hand control makes dome go but DDWCP picture shows shutter operating B5 starts dome home in wrong direction and/or shutter shows wrong % open	AZ sensor signal disconnected or faulty (DDW uses az signals to know rotation not shutter is occurring)	Check Az sensor and cables.
Dome rotates but cartoon does not move or goes backwardse	Check Show Data. Should show PXX data while turning. If PXX>circum ticks (see App1), cartoon will not work Ax sensor may be installed backwards and Training faulty-check ShowData see App 1	Go home to reset Pvalues Switch DIP7 off and retrain, or reverse sensor arm or signal wires.
Dome refuses to rotate at all unless primary power shut off/on	Likely result of ESC chip 10 minute running interlock operation caused by long move command	Identify source of problem. Most common is water in hand control.
Dome begins closing when it should not (with beeping)	DDW requires regular query from DDWCP or it will shut. If computer is busy with another program, DDW may timeout.	Reduce computer load, e.g., introduce breaks in computer activity
Shutter stops partway open or closed	Interruption of shutter current	Check all connections in shutter circuit Clean sliding contacts
Entry switch sometimes takes two tries before shutter begins to open	If power to DDW was shutoff, DDW does not know shutter position. First switch operation will try to close shutter (default). Once it knows shutter closed, next switch op will open.	Operating correctly.
	Following are possible failures that normally require factory service or replacement parts.	
Hand control B5 or entry switch produces unusual beeps or actual motions	May have excessive loading on UNI input due to pilot lights or other loads causing susceptibility to false slaving commands	Replace hand control, entry LED. Call for assistance.
Hand control buttons intermittent	Poor contacts	Replace offending buttons
Hand control B5 makes DDW beep but no action	B5 may be bad (intermittent open)—triggers beep but fails to remain connected for proper command (interpreted as stop)	Replace B5
Dome properly starts home CCW then reverses	Diode array fault	Return for diagnosis/repair
Dome rotates CW as soon as powered on	FET burned out or short through ground	Return for diagnosis/repair
Dome turns only CW Shutter will not close	REV relays sticking open REV relays sticking open	Unsnap relay cover and push contactor/ clean contacts
Dome turns when shutter command	SHUTter relays sticking open	Return for diagnosis/relay replacement

DDW Internal Interlocks

DDW3 has a large number of interlocks of differing types. These interlocks are designed to protect the observatory, contents, and users from damage. Most interlocks are entirely within the DDW control unit processor; however, some are shared with **DDWCP**. Some may be bypassed by computer commands, switch or other settings, or not at all. Following is a summary listing of the interlocks and where they are activated.

This is an operational interlock list, and is NOT a list of all user controlled settings (e.g., weather interlocks), feedback, and system capabilities. This list should be read in conjunction with the Instruction Manual.

Interlock	Purpose	Action & Logic	Where (DDW vs DDWCP)
Motor Slip	Protects rotation motor from damaging drive surface if slippage is occurring	Cuts off rotation motor if dome azimuth does not change during any two second period. Does not function under hand control.	Uses sensor in dome, decisions within DDW. No user control.
Comm Timeout	Closes dome if contact lost	Closes dome if DDW not queried within eight minutes. If closure interrupted, will make up to five attempts to close.	Decisions within DDW. Any control action resets timer or can turn DDW off/on and operate w/o computer
AutoPark	Protects scope from wire wrap if left running	Sends park commands to scope when shutter closes, or if power fails then returns.	Decisions within DDW. DIP switch for autopark. Manual park and override available in DDWCP
End of Travel	Cut off shutter motors at end of travel	Special relay on dome turns off shutter motor at end of travel. Reduction of current to zero is detected in DDW, drive voltage cut off, and EOT defined. Does function under hand control.	Current sensing in DDW. No user control.
Shutter Minimum Motion	Assures that intermittent in shutter current is not misinterpreted as end of travel	Shutter must move for at least 5 sec. in new direction before a current cutoff is interpreted as end of travel.	Decision within DDW. No user control but can always run to EOT in reverse, then redo desired direction
Motor Duration	Prevent fault from causing motors from running indefinitely	Rotation and shutter motor current detected and timed for 8 min. then cutoff.	Detection and decision within DDW and ESC chips. No user control.
Home overshoot	Return to home if dome coasts past	If command sent to go home and dome coasts past home, rotation motors will pulse in reverse ten times to return home.	Logic within DDW. No user control.
DSR Swingout	Prevent dome rotation if DSR Swingout is open	If dome is home and shutter at EOT, detects whether DSR is open and interlocks against rotation	Decision within DDW. No user control but can be wired to satisfy interlock if no DSR swingout present
AutoShut	Closes dome if session length exceeded	Times session	Decision within DDWCP, sends command to DDW. User sets duration, bypass in DDWCP.
Weather	Protect observatory from weather.	Sensors on/near dome send readings. Compare to settings, send close command	Sensors feed into DDW, transmitted to DDWCP, compare to settings in DDWCP, then Close commands sent to DDW. User settings in DDWCP.

Ch. 4. ADVANCED REMOTE CONTROL

Introduction

DDW can be used in a variety of ways for observatory remote control. For example, there are multiple ways of slaving the dome to the telescope, and different ways of using the DDW from long distance. This section discusses a variety of issues in more detail than earlier in the manual. If you need more information, or want to discuss problems or options not described in this manual, please feel free to call us.

Remote Control Astronomy

Remote Control Astronomy is the term we use for custom, external control of the observatory using movement commands sent to the DDWCP. Some persons will create custom scope software, which will include direct transmission of commands to the DDW, and will handle information returned from the DDW. Appendix 1 describes the file protocols needed to write that software.

We have discussed having the scope controlling software write the data necessary for DDW slaving to a data file (called SCOPE.DAT) which the DDWCP reads for the scope RA and Dec (this is how TheSky V5 operates). DDW then writes the resulting data to a similar file which the scope control program can use, if desired.

We have two other means by which a user can control the DDW via DDWCP. The first is the use of an RCA File interface and the second is the use of ActiveX scripting methods. These are briefly described here, and in more detail in App. 6.

File (RCA) Interface. Instead of simple scope direction information, a dome control program could send simple text commands to a control file that is read by the DDWCP (One can also send movement commands to DDW via a command file system). That is, you can use file transfer to send commands to open or close the dome or take other actions. Although slightly slower than sending direct commands to DDW, this approach is much simpler to implement. By extension, we also propose that similar protocols would be useful for manufacturers of telescope and CCD software and hardware. Information necessary to implement any or all these options is given in Appendix 6.1

ActiveX. ActiveX is a term used for a method of writing scripted commands (and responses) similar to macros. ActiveX is used with Visual Basic and similar programming languages. Using ActiveX scripts, the user can command the dome to operate (via DDWCP) and receive and evaluate response data. We follow the ASCOM protocols, which you can find easily on the Internet. Writing a simple script is easy for a person comfortable with Visual Basic; however, complex automated operations require a major effort to handle all possible contingencies and to interface the various devices (scope, dome, CCD). The basic information on the ActiveX command set is given in App. 6.2

German Equatorial

Because the German Equatorial Mount (GEM) has an optical axis that is offset from the polar axis, as the telescope is swung side to side (i.e., East or West of the mount) the optic axis swings relative to the dome. To visualize this effect, assume that the pivot point of the mount (see Drawing) is at the center of the dome. Depending on BOTH the declination and Right Ascension of the object, the latitude of the observatory, AND whether the scope is on the East or West side of the mount, the scope will NOT in general be aligned with the radius of the dome. That is, the scope azimuth will NOT equal the dome azimuth: slaving the dome requires computation of an azimuth offset so that the scope will aim out the center (or other selected part) of the slot opening. This correction may be ignored if the scope size and side to side shift are small compared to the slot opening.

Note that a yoke mounted scope mounted at the center of the dome has no required offsets (i.e., equal zero).

Therefore, whatever slaving method is used, a full GEM installation requires that you tell DDW about the geometry of the mount as it is installed in your observatory. This is done once by inputting values into the RCA menu, which is a part of the Configuration screen, as was discussed in the previous chapter.

The accuracy of the slaving depends on the accuracy of all the factors used in the calculations. This obviously includes latitude and longitude, but includes other factors as well. These include the EW and NS offsets of the pivot point, the vertical and German offsets, Time Zone, and dome radius. It is easy to forget that the system time and the dome training (i.e., accuracy of the Home azimuth) must also be accurate.

One might be tempted to provide rough values for some of these parameters; however, if you do, you will find that the slaving is accurate in some directions (as the errors cancel one another), and quite large in other directions (as the errors geometrically add). In general, the linear measures should be accurate to better than one inch, and the angles to better than one degree. The larger the dome, the larger the scope, and the smaller the slot opening, the more accurate the data entries should be.

Dome Centering and Custom Slave Settings

Under LX200 Adapter control (no DDWCP), the scope will move (while the dome stands still) until the difference in the azimuth of its axis and that of the slot opening exceeds the “Dead Zone” (DZ), where upon DDW will move the dome to correct the error. The DZ is set by the DIP switches on the DDW circuit board. The dome will move until it has moved a distance equal to the DZ in the other direction (we call this the automatic offset).

When RCA is used, the movement process is more complex because the DDWCP has a separate “Tolerance” parameter. In general, the effective DZ will then be whichever is greatest: the “Tolerance” or the DZ set by the DIP switches. Once movement has occurred, the automatic offset will still be equal to the DZ setting of the DIP switches. Thus, if $DZ=5\text{deg}$, and $\text{offset}=7\text{deg}$, the azimuth error will increase to 7deg ., the dome will then turn to align the centerlines, then continue to 5deg on the other side.

In either LX200 or RCA mode, you can turn off the automatic offset using the proper DIP switch. If that is done, the dome movement will align the scope and slot centerlines. Of course, all these movements are subject to some variation (normally 1-2 deg.) depending on the dome operating conditions.

Communicating with the Observatory via Network

As noted in Ch. 3, under the Configure screen one can select to communicate with DDW over a network. This requires that the user has a computer available to him/her, and that a computer is in or near the dome that is connected to the network and to DDW. In the Appendix on this subject we describe some of the theory of making this connection. As this system is still under active development, please feel free to call for details and for the latest software and instructions.

Using TheSky v5/v6 with DDW

TheSkyV5 provides a planetarium program (graphical star/planet presentation) as well as remote telescope control functions. Depending on the telescope mount, TheSky may provide only a subset of the available commands and data services actually provided in the mount.

As discussed elsewhere in these instructions, TheSky writes the scope RA and DEC to a file, which can be accessed by DDWCP for use in slaving the dome. To accomplish this requires several steps.

- In TheSky, turn on the file writing by clicking on Telescope/Server and checking the box "log current telescope position to a file" to start file writing. Take note of the path to the file, the default path for V5 is: *C:\Program Files\Software Bisque\TheSky\User\Telescope Position.txt*
Default path for V6 is: *C:\Program Files\Software Bisque\TheSky6\Data\User\Telescope Position.txt*
- In DDWCP, configuration, you have to be sure the path to the file in DDW Configure/Slaving (which tells DDW where to look for TheSky file) is the same as the path in TheSky
- Note that TheSky updates the file every few seconds, and the DDW reads the file every few seconds so there is not always an instant response by DDW.
- Be aware that TheSky stops updating the file when TheSky is not in “focus” (i.e., on top of the other windows) on the control PC. This is not normally a problem if you or other equipment do not slew the scope away from the last RA and DEC selected in TheSky; however, manual slewing or slewing of the scope from other programs will not have the new RA and Dec written to the file until TheSky is clicked.

Also for your information, while most scope commands in TheSky are easy to find, the synch command is not (synch allows you to tell the scope to reset its knowledge of RA and Dec to a particular object you have identified). Synch is available in the object information box you get when you select an object. Click on the double down arrow on the lower part of the box, then on the “telescope” tab item. You will find the synch command!

Sienna Software Starry Night

This is a planetarium program that provides scope control via third party “plug-ins”, ie., not from within the program itself (as in TheSky). In fact, three distinct components are necessary to use this program for dome control:

- The Starry Night
- Astronomers Control Panel (ACP) which works with SkyPro to provide scope control
- Plug-in for ACP to get scope data for DDWCP

For the convenience of our customers, we provide both ACP and the necessary plug in to allow DDWCP to work with either the ACP running alone, or when ACP is getting star direction from Starry Night.

We expect that there will be more programs that operate in this mode: please call if the program you want to use is not covered in this manual.

Using The AP GTO Mounts and DigitalSky Voice

The DigitalSky by Astro-Physics does not at this time provide scope position file information to DDWCP. Therefore, you cannot use DigitalSky to slave the dome to the scope.

In a recent (2001) revision to the AP GTO control system, AP now supports the LX200 get azimuth command. Therefore, DDW can use the LX200 direct interrogation mode to obtain the azimuth directly from the mount. To use this, the astronomer will need to make a simple cable adapter to obtain the proper wires, and will need to be aware that the geometric offsets will mean the slaving accuracy will not be high.

For most users, the best means to slave the AP mounts is to use TheSkyV5 to control the telescope, and to operate the parking functions for remote operation.

For your information, if you wish to connect the AP mount to your PC using a telephone cable, do it as follows. Use a double male DB9 connector at the scope, and an SBC/PC1 adapter to connect to one of our telephone cables, which in turn plugs into an SBC/PC1 adapter into the serial port.

Fast Dome Tracking Function

Normally, a command to the DDW to rotate will take some seconds to accomplish and the result returned. If you wish to use the dome for fast satellite tracking, this response may not be sufficient. We have provided a method of sending virtually real time commands to the rotation system via DDW so that you can have a very responsive dome, while still keeping the interlocks and human interface.

The method requires that your scope control program determine the desired dome movement, taking into account the physical characteristics (speed, inertia, etc.) of the dome. You may also need to take into account the anticipated path of the object being tracked, especially whether it will go over zenith, requiring fast and/or anticipatory movements of the dome to keep up. This could be written in a Visual Basic or other program.

The program would then use the commands available (see App. 1) to switch into the fast tracking mode, and then send real time motion commands to the DDW to control the motors (approximately ten updates per second). The fast tracking commands allow the user almost instantly to control the motor voltage (via the setting of the pulse width drive applied to the main motor transistor switch) while tracking the position (and velocity) of the dome.

A sample program is included in the DDW program set which allows the user to test the fast tracking function. The program is open source, so you can use it, modify it, or copy it, or use it as the basis for your own dome tracking

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program. We do request that you let us know of your results, and that you make any resulting program and
documentation available to other users.

Please call for further details or assistance in such an effort.

Appendix 1 DDW Software Commands & Hardware Design Notes

Software Commands

For Direct control, commands are sent to DDW in simple ASCII form. This discussion is for the use of those who may wish to write their own dome control software. It may also be useful to those interested in understanding in more detail the operations of the various commands. There are two versions of Digital DomeWorks firmware, Versions 1 and 2 (Version 1 is in DDWModel 1, recognized by the 28 pin main processor, while Version 2 is in the DDW Models 2 and 3, recognized by the 40 pin processor). Since Version 2 is a superset of Version 1, the commands common to both will be discussed first.

Because the DDW microprocessor used does not include extensive buffers of the communication line, if the DDW is busy when the command is sent, the command will be missed. When no movement is occurring, DDW listens for commands for 1.0 sec., then spends approximately 0.1 sec on other housekeeping, before listening again. While movement is occurring, all commands are ignored (except for All Stop, see below). In general, if a command has no response within 0.1 sec, a retry should be made 1.50 sec later.

All commands and return data are at 9600 baud, 8 bit, 1 start, 1 stop, no parity. Commands and data are normally sent without a carriage return (ASCII char 13) or Line Feed (ASCII 10) and there are no checksums in the commands or responses. Note that if you send a carriage return after a movement command it may be interpreted by the DDW processor as a stop command which will terminate movement before it begins (see below).

GET INFO. Form is GINF. When received, the DDW will respond immediately with the following data record (see next page). Data fields are comma delimited. Movement commands always conclude with INF packet transmission.

Note that actual azimuth in degrees is $359 * (\text{ADAZ} / \text{DTICKS})$. Ticks are the number of counts produced by the movement sensors (roughly equal to one inch).

Shutter status is derived from the most recent operation of the shutter. When the system is turned on, or if a shutter movement is interrupted, the status is indeterminate. After the shutter operates to completion, shutter position is considered to be known, and is reflected in the status.

Slave status is the current setting of the SLAVE control bits in DDW.

DSR Status shows the status of the Swingout DSR. On Home-Dome/Pro-Dome, external entry products, the DSR must be closed before dome rotation can safely be done. Because the DSR is on the dome, checking the DSR is only possible (in DDW) when the dome is HOME. The specific design of DDW also requires that the shutter be fully open or closed for the DSR determination to be made. Therefore, whenever the dome is to be rotated away from the HOME position and the shutter is in full open/close, the DSR status can be checked before movement is permitted.

Slave On. Form is GSLV. This command turns on the LX200 slave mode in DDW so that the azimuth will be read by DDW from an LX200. Normal time between azimuth readings is 6 seconds, which gives an average 3-second delay. (If DDWCP is configured for receiving azimuth information from the telescope control program, a menu item on DDWCP will cause DDWCP to get the azimuth from the scope program and transmit GOTO azimuth commands regularly to the DDW- in this case GSLV is not sent). Response is INF package.

Slave Off. Form is GVLS. This command turns off the slave mode. Response is INF package.

DDW3 (DDW1 is Field 1-9 and car ret)

Field	Content	Note (each datum is separated by comma)
1	V#	Denotes Version Data. E.g., V1
2	Dticks	DTICKS is dome circumference in ticks 0-32767. Value is sent as a string of characters, e.g., 457. Leading zeros not transmitted.
3	Home1	Azimuth location of the HOME position in ticks 0-32767
4	Coast	Coast value in ticks (0-255)
5	ADAZ	Current dome azimuth in Ticks 0-32767
6	Slave	Slave Status 0=slave off 1=slave on
7	Shutter	Shutter status 0=indeterminate, 1=closed, 2=open
8	DSR status	DSR Status 0=indet, 1=closed, 2=open
9	Home	Home sensor 0=home, 1=not home
10	HTICK_CCL	Azimuth ticks of counterclockwise edge of Home position
11	HTICK_CLK	Azimuth ticks of clockwise edge of Home position
12	UPINS	Status of all user digital output pins
13	WEAAGE	Age of weather info in minutes 0 to 255 (255 means expired)
14	WINDDIR	0-255 wind direction (use (n/255)*359 to compute actual direction), subtract dome azimuth if weather module is mounted on dome top.
15	WINDSPD	Windspeed 0-255 miles per hour
16	TEMP	Temperature 0-255, representing -100 to 155 degrees F
17	HUMID	Humidity 0-100% relative
18	WETNESS	Wetness 0 (dry) to 100 (soaking wet)
19	SNOW	Snow 0 (none) to 100 (sensor covered)
20	WIND PEAK	Windspeed Peak level over session 0-255 miles per hour
21	SCOPEAZ	Scope azimuth from LX-200 (999 if not available)
22	INTDZ	Internal "deadzone"- angular displacement around the dome opening centerline within which desired dome azimuth can change without causing dome movement.
23	INTOFF	Internal offset- angular distance DDW will add to the desired azimuth, causing the dome to precede the telescope's position when a slaved goto occurs.
24	car ret	
25	car ret	

Note, weather data fields 13-20 are only updated ONLY if TI Weather Station, (discontinued in 2006), is installed. If a TI Weather Module is not attached, (or not functioning), or the Age reaches 255, all weather values will be set to 255 and 0.

GOTO Azimuth. Form is GXXX where XXX is the desired dome azimuth in degrees. Leading zeros must be included, e.g., G073. Minutes and seconds may be transmitted, but are ignored. When the command is received, DDW begins execution. If the required change in azimuth is less than the "dead band" set either by internal logic to 10 deg in Version 1 or by dip switch settings in Version 2, the dome will not turn. When the dome is turning and approaches the target azimuth, DDW allows for coasting (as determined in the TRAINING mode) and shuts off the motor early. When the GOTO begins executing, it sends an 'R' or 'L' to show that it will turn in the CW or CCW direction. Version 1 systems then send a 'T' character each time there is an azimuth tick (normally about one inch of movement). Version 2 systems will send a string 'Pnnnn' where nnnn is the current dome azimuth tick value (See INF packet) for each azimuth tick. When the action is completed, DDW sends an INF packet. Power cutoff will cause loss of current azimuth data, requiring the user to recalibrate using GHOM. If the power is turned on in with the dome in the HOME position, DDW calibrates itself with no movement required (this will normally be shown in the DDWCP screen). In chips prior to 111201, a GOTO that is within the coast distance (as well as the dead zone) will be ignored. In chips 111201 and later, the DDW will automatically bump the dome 0.1 seconds toward the

proper azimuth (feature added to improve slaving of domes with large coast). Also, all rotations are preceded by three quick beeps.

GOTO HOME. Form is GHOM. When received, the dome will rotate to its HOME position as defined by the shutter contacts. If the dome is already at HOME, no movement will occur. GHOM should be executed whenever the DDW is turned off, then on (turning off DDW causes it to forget where the dome is). When DDW executes this command, the dome turns until HOME is detected, then the motor shuts off. If the dome coasts past the HOME position, DDW will pulse the dome in reverse up to ten times to recover the HOME position. 'T' and 'Pnnnn' responses are same as GOTO, and the operation is concluded with an INF packet.

Train. Form is GTRN. When received, the dome will begin a training sequence. The starting point of the dome is assumed to be NORTH, i.e., the dome should be manually turned to face NORTH before GTRN is invoked.. The dome will rotate CW to HOME (thus defining HOME azimuth), then continue CW to HOME a second time (thus defining the circumference). DDW will then record its HOME, circumference, and coasting data in non-volatile memory. Responses are same as GOTO. Training data are held in non-volatile memory, and are not lost in power cutoff.

Shutter Open. Form is GOPN. When received, dome will return HOME, then open the shutter.

Shutter Close. Form is GCLS. When received, dome will return HOME, then close the shutter as above.

Shutter opening or closing is performed by DDW energizing sliding contacts to the shutter motor with normal or reversed voltage. Shutter opens/closes until the shutter opened/closed interlock cuts off the motor current. This is interpreted by the DDW processor as end of travel, which sets the shutter status (0=indeterminate, 1=open, 2=closed). DDW does not have relative shutter position sensing, nor is there provision for remote partial shutter opening (a hand operated "manual" control can be used for this purpose). During shutter operation, an initial "O" or "C" is sent, then the character 'S' is transmitted approximately every 0.1-sec. If the dome is not in the Home position, "Pnnnn" packets are sent during the rotation. After both the rotation and shutter motion stop, an INF is sent.

During manual rotation/shutter movement, both versions will transmit Pnnn and "S" strings to reflect the activity. Once action has ceased for approximately 2 seconds, an INF packet will be sent. This has subtle implications for the client end software- it must be prepared for motion at any time, not just in response to a command initiated by the user.

All Stop. Form is not defined. When motion is occurring, any two or more characters are received within one second from the communications line is interpreted as an all-stop, which results in all motors being turned off and an INF packet sent. Hint: if you are sending movement commands, do not also send a carriage return or line feed.

GSPK - Parks the LX-200. Sending this causes the DDW to direct the LX-200 (or compatible) to switch to guide rate and slew east. This has the effect of stopping the telescope guide motors. DDW automatically sends this command 4 minutes after the last dome command when the dome is both home and close. This is a safety interlock, preventing the Meade LX-200 from wrapping its cables about itself and breaking them. Meade has claimed this cannot happen, however we twice nearly broke our declination cable because of this "cable wrap". Response is INF packet.

GSRK - UnParks the LX-200. Reverses the effects of GSPK by switching to guide rate and slewing west, resuming a tracking motion. Response is INF packet.

GSSK - Cancels the 4 minute Scope park timeout. This is sent to disable the 4 minute countdown until the next dome movement. All dome movements (even manual) rearm this countdown. Response is INF.

GPnn - Manipulates the user output pins. 'nn' is interpreted as a hexadecimal number ranging from 00 through FF. Version 2 hardware implements two user outputs, so only the least significant two bits of the least significant hex digit have effect. If bit 0 is on, user pin 1 is turned on. Bit 1 controls user pin 2 in a similar fashion. The current status of these pins is available from the INF packet. Response is INF packet.

XST - Indicates the 4 minute Scope Park countdown has initiated.

XSX - Indicates the 4 minute Scope Park countdown has been reset- but the countdown will not resume until XST is received.

GTST – This command causes DDW to respond with a packet of test data for use in diagnostics. The data response is subject to change. At this time, the packet includes the following data, each presented as a character followed by numbers on the Show Data screen:

- Bank 1 interpreted reading “bXX” where XX=0-15.
- Bank 1 ADC reading “aXXX” where XXX=0-255
- Bank 2 interpreted reading “BXX” where XX=0-15
- Motor Current ADC reading as “mXXX” where XXX=0-255. Motor off should read 0 or 1.
- DSR voltage ADC reading “dXXX” where XXX=0-255. Not Home>250, Home & DSR open about 50, Home & DSR closed about 5.
- Stop code reading showing cause of most recent movement stop: 1=reached target, 2=rot time limit reached, 3, no az sensor (rotation) or no motor current (shutter), 4=AllStop, 5=incoming user command

GTCK-This command switches the DDW into Fast Track mode. See detailed discussion below.

Fast Track Mode

The normal (astronomy) mode of DDW provides for sending a command from PC to DDW, executing the action by DDW, then transmitting the full INFO packet back to the PC. Even if no movement is involved, this process takes about one second. If movement is involved, during the movement DDW will transmit tick values, but no other information until the final INFO packet.

In contrast, the DDW Tracking mode allows a PC program to get rapid feedback about a dome's rotation, and send control signals to change its speed in real time. To accomplish this, a special DDW command "GTCK" switches the DDW chip into tracking mode. The PC then sends special four byte commands for direction and speed, and receives back four byte packets (was ten bytes in DDW Model 3 and prior) providing position information. This mode can operate at over 10 command cycles per second if desired. Tracking mode can be switched on and off remotely and modified on the fly. DDW normally ships with an open source Visual Basic sample fast track program (which includes creation of an automatic log file) on the program CD as a starting point for programming.

GTCK Converts normal DDW mode into Tracking Mode

Command Packet.

CSDR General fast tracking command format. Each character position is used to transmit particular command data. All alpha chars must be capitalized
The first character location showed by the C is the command character where: .

- X - exit tracking mode back to normal
- U - update PWM variables
- R - rotate clockwise
- L - rotate counterclockwise
- S - stop rotation
- ? - just return current stats

SDR are characters whose value is 0 to 255. The PWM (pulse width modulation) provides electronic speed and startup control via the ESC chip. Refer to the ESC documentation for details on what the PWM variables mean. The three characters are:

- S represents the PWM startup voltage, ranging from 0-255
- D represents the PWM ramp delay, ranging 0 to 255
- R represents the running PWM, ranging from 0 to 255

Response Packet

The DDW chip receives each 4 byte command, immediately executes it and responds with a four byte packet. The response packet contains the instantaneous dome rotation status as discussed below;

B y t e	Description
0	(isAllstop) represents the AllStop flag (>0 indicates something is asserting stop)
1	(rotDir) rotation direction flag, 0=no rotation, 1=counterclockwise, 2=clockwise
2 , 3	(drCount) instantaneous dome position in ticks (hex)

Notes

Value calculation. Each field contains 2 bytes, the low order first. Thus, to get the current dome position in ticks, the following is needed; $ticksPos = b2 + (b3 * 256)$ where b2 the 3rd byte, and b3 is the 4th. Note the values of some fields don't require 16 bits.

In addition to returning the status packet, some commands sent to the DDW will update the ESC's PWM variables. The PWM update happens just before the status packet is sent back. Note the PWM starting value is superfluous after rotation is started, but eliminating it would complicate the algorithms.

The PWM variables range from 0 to 255 as documented by the ESC specs, but the user should never send all 3 as 255 in a single command, as that will switch the ESC to ADC mode where the ESC chip is reading the PWM from the adjustments pots. Subsequent commands will switch it back correctly, but manual rotation started before the next valid PWM values are transmitted will use the ADC settings. In order to return to normal DDW operation, and properly reset the ESC, use the 'X' command byte as above. DDW then responds with a standard info packet and returns to normal operation. Please note the 'X' command ignores the PWM variables, so they can be left at some convenient default- but they must be included.

When client software wants to start the dome rotating, a 'R' or 'L' command byte must be sent. If the dome is already rotating, the PWM variables are correctly updated, but the command byte is ignored. The client software will receive no indication of this condition. Therefore, the program should perceive that rotation is occurring (via the rotDir flag) and not send rotation commands until the stop command has been sent and the rotDir flag is = 0. If 45 seconds elapse between commands while rotation is occurring, DDW unilaterally stops the rotation, but stays in tracking mode. This is an interlock intended to prevent dome runaway in the event of software/hardware failure.

The 'U' command can be used to update the PWM variables at any time, without affecting the rotation direction- or starting any. If, during rotation, the run speed is brought to 0, rotation stops. If the 'S' command isn't sent, DDW still considers the dome to be rotating, so subsequent rotation commands only affect the PWM settings. Effectively, the dome will only rotate in one direction as the PWM run setting is increased from 0, ignoring rotation commands in the opposite direction, until 'S' is sent. It is up to the client program to be aware of this behavior. The 'S' command updates the PWM variables, but stops any rotation begun by tracking mode commands.

The '?' command will return a status packet, but not update the PWM variables. Like the 'X' command, it requires the PWM entries contain bytes, but ignores their values.

The client software must retrieve information such as the dome circumference or home position via a standard 'GINF' query before entering tracking mode. Attention should also be paid to the DSR status and shutter position, as those cannot be monitored or controlled while tracking mode is in progress.

In Tracking mode, while rotating, DDW will respond to the AllStop input by immediately stopping rotation. Rotation commands will be ignored while AllStop

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remains in effect. The B5 button, Slave and Shutdown inputs are ignored in tracking mode. A program is free to switch in and out of tracking mode as desired.

Hardware Design Notes

This section is written to help a regular user better understand the DDW system, and to assist in maintenance. This is NOT an exhaustive discussion of the system, as that would be too complex. For example, we describe only a few of the design considerations (why things are designed the way they are), nor do we describe much of the inner workings of the firmware. Rather, we focus on the information needed to understand the operation of the electronics and general system behavior.

DDW is a smart system: that is, it is designed to operate autonomously for a variety of functions, as well as to respond to external commands from a variety of sources and at varying levels of detail. The most common external command source is the DDWCP operating in a PC, sending commands to the DDW unit. The DDW processor contains one-time memory into which we have burned the firmware (program) that runs DDW. This is non-volatile memory, and can not be changed or updated. Changes in the firmware require a new processor.

The configuration information needed by the DDW processor includes the dome training data and certain other information. These data are stored in the EPROM 24LC01B. The data are read whenever the DDW is turned on, and written whenever the dome is trained.

The DIP switches are in two banks of four. Each bank switches resistors in a binary code that feed a voltage into DDW processor ADCs. The processor decodes the ADC reading to determine the DIP switch settings.

RS232 data lines to and from the PC (or an attached LX200) are protected by +/-15V snubbers and resistors. The signals are fed through the MAX232 that shifts the RS232 +/-12v data to/from TTL serial 0/5V data.

Lets now go to the motor end of the system. The rotation motors (DC) are connected at all times to the 12V power source. The main FET (on the heat sink) is normally off, and thus prevents rotation motor operation.

If the **hand** control CW is activated, 12v goes through the connecting diode to the ESC. Here the signal turns on a level shifting transistor circuit, which applies 5V to the small ESC PIC. When the program in this PIC detects an input signal, it starts generating a positive pulsed output at about 50Hz. The starting width of the pulses is set by the START potentiometer. As time passes, the width increases at a rate set by RAMP to a maximum width set by RUN. This pulse train is again level shifted back to 12v, then applied to the main FET which turns on from the pulses. The result is an increasing voltage applied to the rotation motors so that the motors start slowly.

When the incoming signal to the ESC ceases (remove the CW button), the ESC immediately stops the output, dropping the voltage to zero. In practice, the motor continues to coast for a few seconds.

Meanwhile, as the FET switched on, the current passes down through the FET and through the 0.1 ohm resistor which generates 0.1v for each ampere. The resistor is shunted by a Shottky diode which limits the voltage to about 0.2-0.3v (thus reducing the power loss). This voltage measures the presence of the motor current. It feeds through a 0.2sec. RC into the processor ADC. The functions of this reading are described below.

An alternative way to go CW is to send a GOTO command from DDWCP to the DDW. When this happens, the processor generates a motor signal which moves through steering diodes to the input level shutter of the ESC circuit where it operates as did the manual signal.

The operation is more complex for the CCW action. In this case, the CCW button not only sends the motor control signal to the ESC, but it also pulls down the Reverse Relays. These reverse the power leads out to the rotation motors, thus reversing direction. Similarly, a CCW signal from the processor generates both a motor signal and actuates a transistor that turns on the reverse relays.

A major consideration in the circuit design is to assure that the relays never move while current is flowing through their contacts (this greatly extends their life). This is assured by delays within the processor, as well as by the delayed current start and the fast current stop in the ESC (which happens faster than the relays can drop out).

The shutter operation is more complex. A shutter button (or processor command) will operate the shutter relays that transfer the output from the rotation motors to the shutter motors, as well as the ESC motor drive circuit. The CLOSE command will also operate the reverse relays. When the shutter reaches the end of travel, the current is cutoff by the shutter relay on the dome, and this current cutoff is detected by the DDW processor which then causes it to shut down the shutter relays and ESC signal.

Hint. The relay covers are transparent allowing you to watch the relays to be sure they are moving properly.

The azimuth movement sensor uses a rotating wheel with holes. As the holes pass an infrared sensor, the beam is interrupted, thus producing a signal for the DDW processor. The processor knows the distance moved by the number of "ticks", and

- It knows that rotation is occurring if there is non-zero motor current plus rotation ticks
- It knows shutter motion is occurring if there is non-zero motor current and no ticks
- It knows direction by whether the reverse relays are activated (processor has a sense line to the relay coil)

Under **hand** operation, you have direct control of the relays and motors (ie., the processor is not controlling, it is only “observing” what is going on). The DDW will interpret the signals to infer what your hand is doing, and will use these data to track the motion and to send data back to DDWCP. Hint. Failure of some components can lead to bizarre results. For example, a **hand** rotation with a failed azimuth signal will be interpreted by DDW and shown on DDWCP as a shutter movement (this makes a great diagnostic). A processor directed rotation with a failed azimuth signal will start the dome rotating, which will then cut off within 3 seconds due to the rotation interlock.

Under **processor** operation, things are different. For example, a command to rotate will trigger the motor signal, and the expectation that ticks will begin arriving. If no ticks arrive within 3 seconds, DDW interprets that as a failure of the dome rotation, so it shuts down the motors. The motor current reading is ignored. However, a command to operate the shutter will run the shutter motors until the motor current drops to zero (triggered by the shutter relay).

In all processor initiated motion, DDW tracks the time of operation and imposes an 8 minute limit.

Another subtle area to understand is the data to and from the rotating dome itself. There are five distinct “signals” to and from the dome via the sliding contacts:

- Power for the shutter motor
- Signal to detect whether the DSR Swingout is open or closed
- Signal to detect when the sliding contacts are connected, ie., the dome is HOME
- Detect the interruption of motor current at the end of travel
- Power to supply the weather rechargeable battery

Power (as a reversible 12V) is applied up through the contacts to operate the shutter relay and the shutter motor. The motor is normally disconnected by the shutter relay. When the applied power is more than about 6-8V, the shutter relay will pull in and the shutter motor connected to the sliding contacts. Small signals, less than about 2VP-P will encounter the full wave rectifier of the shutter relay which present a high resistance.

A 20k resistor is present across the sliding contacts at all times. The DSR Swingout has a magnet and switch that closes when closed, which inserts a 220ohm resistance. Thus measuring this resistance tells whether the DSR is open or closed. The DDW board feeds 5v onto the sliding contacts through a220K resistor. Each side of the sliding contact as a 1k resistor to ground to provide a ground reference that can take the reversed voltage when the shutter is being powered. The resulting voltage on the sliding contacts when the shutter motor is NOT being driven is fed to the processor ADC, and thus measures the DSR status.

When the dome is sent HOME, DDW decides on the basis of its present knowledge of the dome azimuth which direction is shortest. DDW then sends the dome toward HOME. Other than the rotation motor slip interlock, it ignores the azimuth readings.

When the sliding contacts reach the HOME position, the DDW detects that the resistance between the sliders is less than infinity and DDW decides that it has reached the home position and stops the motors. Actually, during training, DDW measures the azimuth location of both ends of the HOME plates, and then measures azimuth from the midpoint.

As discussed above, when the shutter relay interrupts the shutter motor current (normally 4-7 A), the motor current detection shows zero, and the DDW assumes the end of travel has been reached. There is an internal requirement that the shutter must have operated for at least 1 second before a current cessation is taken as an EOT.

The optional on-dome weather instruments require power to operate that is provided by a rechargeable battery on the dome. The battery is recharged in the HOME position by a 2V P-P 5kHz signal that is applied to the sliding contacts from a floating transformer. The signal is too small to operate the shutter relay, and is sufficiently high frequency to be ignored by the DSR and HOME detection circuits and software discussed above.

Appendix 2 Signal Cable Construction and Installation

#22 two conductor wire

#22 two conductor wire is supplied in an uncut roll for use in connecting interlocks, switches, and other low current devices. One conductor has a thin white trace for identification purposes. When making a connection, lay out the wire and cut the ends clean. Strip the installation, and twist the strands of each conductor together to prevent fraying and short circuits. You may want to use a soldering iron to “tin” the wire to make it stiffer and easier to handle. If installing the wire into a small terminal strip, you may also want to double the conductor back onto itself.

Six conductor Telephone Type wire

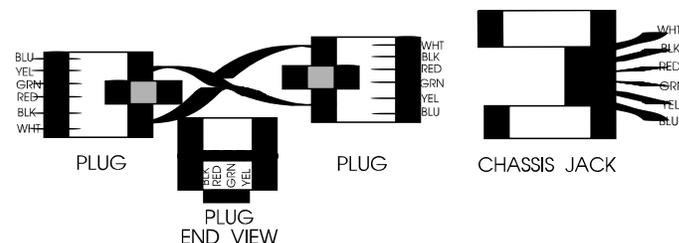
Although most of these wires are provided as precut 6-conductor telephone type flat cables (with RJ14 modular plugs), you may want to cut and install plugs on your own telephone cables. Measure the length needed, and trim the ends clean. You will need a good quality crimper (available from us or from Radio Shack).

To install a RJ14 connector, follow these steps:

- Provide good light! If you cannot easily see the smallest details of this task, you will make mistakes and will not be aware of them. A little extra care in making the connections saves hours of troubleshooting later!
- Use sharp diagonal cutters to trim the end of the cable square. You must not have any metal wire strands sticking out the end.
- Place the cable into the stripping portion of the crimper tool (this has an upper and lower knife to cut the insulation).
- Pull the cable away, thus stripping about 5/16 in. of the OUTER insulation (the insulation on each wire should remain).
- Orient the cable in your left hand with the **black/white** conductors toward the **right** (Depending on the cable type, the black may be second from the right). Orient the connector so that the finger latch is **DOWN (underneath)**. Insert the cable end into the connector until the wires bump the end inside (this is important because some conductors may in time work their way out of their insulation--leaving space at the end of the conductor may then allow them to short together).
- Insert the connector with wire into the crimp portion of the tool. Squeeze the handle and check that the six crimp bars are pressing on the crimp conductors of the connector. Complete the crimp, squeezing hard and firm.
- Remove the connector. Using a magnifier if necessary, inspect the connector closely and check that all six of the crimp conductors were pressed down, and that the wire orientation (black to the right with thumb key underneath) is correct.

Note: the wire orientation in the connector is **absolutely critical**. Contrary to telephone service, the orientation of wiring in this system must be maintained. This is so a signal will always travel on the same color wire through the various connectors and cables.

If the connector is not right in any way, simply cut it off and apply another one. It is virtually impossible to verify that a particular connector is good or bad: If a cable is suspected as bad, cut off both ends and install new connectors. If this does not solve the problem, make a new cable.



WIRE, PLUG, & JACK COLOR CONVENTIONS

Appendix 3 Serial Ports and Cables

Introduction

In the following discussion, we use DEVICE to stand for any device with which you are intending to communicate via RS232. DEVICE may be Digital Dome Works, Dome Wizard, RoboFocus, or other device.

The communication between the computer and the DEVICE is via a "serial" cable connected to a PC serial port, called a COMmunications Port (for purposes of this discussion RS232 and "serial" refer to the same thing). If the settings for the software do not match the port, communication will not succeed. In this section, we'll talk about COM ports.

A standard PC running a recent version of Windows (or alternative operating system) frequently has three serial ports numbered COM1-COM3, which are often assigned to:

- mouse (usually COM1)
- spare(COM2)
- modem (usually on COM3 in our port assignments)

Some PCs have a separate special input for the Mouse (PS/2 style), which frees the COM1 port for other uses.

A remote control observatory may require that the control computer have enough serial ports to serve:

- mouse
- modem (optional)
- telescope
- CCD (may be a USB or parallel port rather than serial)
- DEVICE

Task: You will need to assure that your computer has the correct number of RS232 ports to serve your needs, and you will need to have the proper cables to run from your computer to the observatory. In this appendix, we will discuss both issues.

Serial Cable Options

Regardless of how many conductors the long cable has, we only use three for the serial communication (eg., black, green, yellow on 6-conductor cable).

We provide nominal 12-ft. signal cables to connect your PC to DEVICE. This will work fine if your computer is in or next to the dome. However, if you need to run longer cables, you can order them from us or easily build and install your own. For relatively short runs (roughly up to 100 feet), you can use standard six conductor flat telephone cable with standard six conductor connectors.

If you are at a substantial distance, say, 100 ft or more. you may need to run the cable in some type of conduit underground, and you may want cable that is physically stronger. The cable for the RS232 can be almost any reasonably low capacitance,

three (or more) conductor cable, for example, CAT5 networking twisted shielded pair. For long runs, use reasonably large wire (e.g., 20 gauge conductors). We have used a variety of wire types, including "thermostat" wire (4 conductor) and even Romex #14 building wire (2 wires plus ground).

The easiest and most flexible way to make the connections is to use a standard 6 conductor telephone jack (female) with wire leads. You can then simply hook the proper wire color to each of your long wire conductors, and then use our standard (or your own) phone cables for inside the dome and control room. The colors we use are Black (ground, DB9-5), Yellow (PC in DB9-3), and Green (PC out DB9-2). You can also use various other types of connectors (eg. DB9, use numbers above plus jumper DB9-7 and 8). See the schematic of connectors in the rear of this instruction manual for further details.

Parallel Cable Options

As noted, some CCD cameras require parallel cables. Standard lengths are 10-25 feet. However, you can make or purchase cables up to 100 or more feet long; however, they do get quite expensive. If you are putting the cable in conduit, you may not be able to get the connector through the conduit. Thus, you can't easily install the connectors ahead of time, test the cable, and then install it. This can make system checkout more difficult. Consult with your CCD supplier for more information. Note that if your control room is far away from the observatory (more than 100 ft.), you will probably find it useful to install a computer in the dome, and run the system as "Long distance Remote" using a local network. This may save money, and is a more flexible system.

Multiple Serial Ports

As noted above, you may need to provide more serial ports in your computer. Many inexpensive "multiport" cards are available to add ports, and most of these cards are supported by modern Windows versions, (many laptops will support additional ports via PCMCIA cards).. If you are using a computer with multiple USB ports, and need additional serial ports, you can also add either single USB to serial adapters or a USB to serial Hub. We can provide advice on additional ports (see below), but the actual installation and debugging is up to you to accomplish.

The programs that control each observatory component include a method of selecting a COM port. For example, in DEVICE, it is done in the Configure. Check the instruction manual for your telescope and CCD software to find how to set the COM/parallel port setting for those devices.

Proper operation requires that each component be connected to the physical port that has been assigned in its software. Failure to plug into the correct, assigned port will result in a "failure to connect" or some similar error message. If the connection is not successful, you will receive a message to that effect.:

USB

Although we have plans to implement a USB port on the Digital Dome Works hardware, most if not all USB to Serial converters have been effective in providing standard RS-232 serial ports. These devices come with driver software that makes the serial converter appear to software as a standard COM port. Several converters may be operated in parallel via a USB Hub to gain multiple serial (and/or parallel) ports. Some software, expecting to communicate directly to a serial or parallel port's hardware, may

not be able to exploit a USB converter- this is dependent upon the software itself. We have tested communications from Digital Dome Works and TheSKY via an USB to Serial converter and found both to work fine under Windows XP and Vista. Extensive reliability testing under different mixes of hardware, tasks and multitasking has not been done, so we are not aware of the possible problems a user may face.

Serial Port Expansion Cards

Newer PCs are supplied with only one (or none), serial ports; a 9-pin male. Depending upon the devices attached to the PC, you will have particular needs with respect to I/O ports. First, the Observatory controller requires 1 COM port- our standard port is COM2, although all our software will support COM1 through COM9. CCD cameras typically use a LPT (printer) port or USB, but some require a serial port and others require both. The Telescope mount will consume either another COM port or an LPT port depending upon the particular mount design.

Modems can either use an existing port, or can supply one of their own- depending upon the modem's design. Internal modems always supply their own, often as COM3 so as not to conflict with COM1 and COM2 as supplied by the main system board. External modems always need a 9 or 25 pin COM port, thereby using one supplied by the main system board or expansion card.

If your system only requires 1 LPT port for the CCD, 1 COM port for the Observatory and 1 COM port for the Telescope mount, it may not be possible to set the system up without requiring additional COM/LPT port cards, or USB Adapters/Hubs.

There are many variations of COM/LPT expansion cards, offering a wide array of port combinations, data rate capabilities and connector styles. In our experience, cards which mix 2 or more COM and 1 or more LPT ports are the most effective in this application. We have purchased cards in the \$40 to \$150 price range, from Jameco Electronics (www.jameco.com) and JDR (www.jdr.com). We select cards which provide additional 9 pin and 25 pin ports, or those with a large cable connector from which dangle individual, short cables with 9 pin and 25 pin connectors. The particular UART chips employed on the card are of little concern in this application and can be ignored unless you have special requirements. If you search around, you may run into the 4 or more port serial boards, costing well over a hundred dollars. These cards are very capable and are specially designed to not "overconsume" system resources as discussed below.

Windows XP and Vista will support COM ports greater than 4, and usually all that is necessary is to Add New Hardware, and the operating system will configure the device

Serial Communications Troubleshooting

If you have difficulty getting the PC and DEVICE to communicate, there are several areas to investigate. The suggestions below start with the easiest first.

System Verification. One of the first steps is to verify that the basic equipment is working. If you have a COM port that works (for example, one that currently serves the telescope), you may temporarily connect the DEVICE (with PC1 adapter) to that port. Set the DEVICE Com port to the same setting that you were using for the port (e.g., in the telescope control software). If you now establish connection, you will prove that the control program and the DEVICE are both operating correctly, the cables are good, and that the problem is in configuring or identifying the proper COM port.

If you still do not connect, you may have a bad cable or connector. Try substituting another cable or adapter and retry the connection.

User of Double Female Device. We can supply a double female adapter that accepts a telephone type connector on each end. The device includes two small LED lamps wired onto our GRN and YEL wires. When connected into the serial line to the DEVICE, these lamps will normally show GRN. (I.e. both the PC and the DEVICE are listening). Each lamp will blink RED when a transmission occurs. Thus, if a normal command is sent (such as GET INFO), one lamp will flicker RED for about a tenth of a second (look sharp—it's quick!). Normally, in less than a second, DEVICE will respond and the second lamp will flicker RED showing transmission back to the PC. Using these indicators, you can determine where and in what direction the communication failure is occurring. In conditions of high ambient light it may be difficult to see the red flicker indicating communication- so please look carefully.

If you are unable to produce a usable COM port for the DEVICE, you may require assistance either to change internal settings in the computer (as discussed above) or to install internal cards in the PC to provide additional COM ports as discussed above. Please feel free to call us for help.

Appendix 4. Microswitch End of Motion (EOM) Sensors

When you command DDW to open or close the shutter, the ES motor turns on. The open/close shutter operations continue until the motor “shuts itself off”. When the DDW senses this loss of motor current, DDW assumes that the shutter is full open/closed and reports that to the user.

In most installations, EOM sensors are magnetic reed switches that activate a shutter relay to control the shutter motor. This appendix describes an alternate system that uses two normally closed microswitches on the underside of the rear cover near the shutter motor. Each switch opens when the shutter is at its end of travel, and each switch is provided with a diode that will shunt the open switch so that reverse motion is possible. Each switch has a spring to allow activation followed by about one inch of travel of the shutter (this prevents damage to the switch).

Each switch installs with screws that allow adjustment. We recommend AGAINST using double back tape, hot glue, or other attachment means. They do not allow adjustment, and are subject to failure. Warning: you should install the switches carefully. A switch installed in an improper location or one that subsequently moves or jams may cause failure of the dome shutter to operate properly.

See figure for appropriate installation locations. The OPEN switch is installed on the left front of the rear cover, and is tripped by a specially installed post on the front shutter. Open the shutter to within two inches of full open. Choose the exact location for the post and switch and install.

The CLOSED switch is installed on the front center of the rear cover, and is tripped by the rear latch as it moves into its locked position. Close the shutter fully, and choose the exact location for the switch. Install.

You will perform final adjustments later.

Appendix 5 - Communicating with DDW by Network

Introduction

Digital DomeWorks supports two methods of communication between DDWCP and the DDW Control Unit. The most common method is to have a direct serial connection (RS232) between the Dome computer and the DDW controller. The second method is called the Redirect Mode and can be used to control DDW over a network. In this case, the DDWCP runs in the User Computer and a small program called Serial Redirector (that we provide) is run in the Dome Computer.

The Redirect Mode operates as follows. When DDWCP wants to send a command via a network to the DDW controller in the dome, DDWCP sends the command over the network using the standard TCP/IP network protocol (which places destination labels on data packets). The Serial Redirector program in the Dome Computer recognizes the destination code, receives the command, and redirects it out the proper serial COM port to the DDW Control Unit. When the DDW Control Unit responds, data are sent back over the network to DDWCP in the User Computer where it is displayed.

What are the pros and cons of running in the Redirect mode?

- Because the control program is running in the User Computer and only small amounts of command data are being transmitted over the network, the program response will appear to be faster than if PCAnywhere were being used. In fact, this process can be used over the Internet, as well. Other devices with low data requirements (such as a telescope control) can also use the same method.
- Redirect Mode only operates over a network, whereas PCAnywhere will operate over a network, telephone line, or other communication system.
- This mode requires that the Serial Redirector program be running in the Dome computer. This means that one must either arrange for Serial Redirector to run whenever the Dome Computer is booted, or that the user connect using PCAnywhere to start the Serial Redirector program.
- Some devices with high data requirements are very difficult to operate with this mode. Specifically, most CCD cameras require a very tight coupling to the host computer when they are downloading, and so would require a complex program in the Dome Computer to handle the operations there. However, if desired, one could run some of the devices using Redirect Mode, even while the CCD camera is being run with PCAnywhere.
- System security may be an issue: although this mode incorporates certain encryption and password protections, the user may require a higher level of security (PCAnywhere offers multiple levels of password, logging, and other security measures).

In summary, there may be situations in which this mode is useful: it is up to the user to decide.

Notice: We designed this set of programs for use by our customers. It is open source, and anyone may use it at no charge. If you wish further details to help you write code for your own application, please call us for further information.

Configuration Setting

The configuration at the DDWCP end (in the User Computer) and in the Serial Redirect program at the DDW end (in the Dome Computer) must conform to one another.

In the DDWCP, use Config/Transport and choose Network connection. You have several entries to make. These entries are stored in the DDW.INI file in the computer.

- **TCP/IP Address.** This is the network name of the Dome Computer (e.g., RemoteDome)—this is the same name that you would use to connect using PCAnywhere. You could also use the multi-digit IP address, in the form xxx.xxx.xxx.xxx. See troubleshooting at the end of this section for address information. If you will be reaching the Dome Computer over the Internet, you must enter the multi-digit numerical address: please call us for further information.
- **Port.** This is a random number that you choose that identifies the port on the target computer. The number must be more than 1024 and less than 16384. This is a required entry.
- **UserID.** This is a word that identifies you. This is a required entry.
- **Password.** This is a password that identifies you. This is a required entry.
- **Encryption.** This is a random series of 4-8 letters that is used as the key in the data encryption algorithm. This may be left blank if encryption is not required.

The Serial Redirector has two different configuration files that require data that match the data in the DDWCP configuration screen. These files can be opened using Notepad or similar program (usually by going to the file in Explorer and double-clicking). Each file contains directions in making the entries. These directions are preceded with semicolons. The actual entries appear toward the end of each file, and appear without semicolons. Do not change any part of the file, other than the desired entries.

The Serial Redirector configuration files are normally changed only by the system administrator to give permission to access the devices connected to the Dome Computer. The files themselves are not protected or encrypted. If security is an issue, they should be write protected or otherwise prevented from change. *The user is responsible for imposing and maintaining appropriate security; for the directory in which this file resides. If the system on which SerialRedirector runs is compromised, or the config/user files are not secured, an attacker can gain unrestricted access to the SerialRedirect services, and/or use the userid and password entries to attack other systems. Please design and follow a coherent security plan before offering any services on any network, particularly the Internet!*

CONFIG.CONF

- **netaddr.** Entry must be the same as you entered in TCP/IP Address, in the Config/Transport section above.
- **netport.** Entry must be the same as you entered in PORT.
- **service port.** Entry is the serial port on the Dome Computer that is connected to the DDW Control Unit

USERS.CONF

- **UserName Password Service.** These three entries are the same as entered in the DDWCP Configuration as UserID, Password, and the service(s) permitted. The entries are put in the order shown with spaces (no commas) in between. The service(s) permitted are the titles of the programs that the User is allowed to access.

See the comments in these two files for further information regarding the various parameters.

Operation

To operate in the Redirector Mode, you must start the SerialRedirector program in the Dome Computer. The user then starts DDWCP in the User Computer, and selects the network connection with the proper entries. When the user closes the configuration screen in DDWCP, the program should immediately make contact with the Dome Computer to get the DDW status information, and this should be immediately shown on the User Computer screen.

If the user receives error messages or the system does not work, verify that the settings are correct, and that the network is functioning.

Troubleshooting

If you have trouble getting Redirect Mode to work, check the following items:

- Is the network working correctly for other applications?
- Is the com port on the host machine in use by another application? If so, the other application must release the com port before Serial Redirector will be able to use it.
- Double-check the agreement between the settings in the Configuration/Transports screen of DDW and the settings specified in the .CONF files. The following items must all agree:
 - Port Number
 - User Name
 - Password
 - Encryption Key
- If all the above items are correct, double-check the TCP/IP address specified in the Configuration/Transports screen. This can be done using the PING command. Go to a DOS window and type "PING *hostname*" (without the quotes), where *hostname* is the name of the machine that's running Serial Redirector. You should see responses from the host machine, and a report from PING on the average round-trip time of the test data packets.

Appendix 6. Remote Control Interfaces

Introduction

DDW supports several different means by which an outside program can operate the DDW. Obviously, the external party can send commands to and from the DDW using RS232 commands. However, most users will want to operate the DDW via the DDWCP running in control computer. Simple slaving using the file transfer protocol in which the scope control program writes the scope position to a file which is read by DDWCP is a special case. We have provided two additional means of detailed external control and data response:

- RCA File interface in which commands are sent to the DDWCP using a simple ASCII text file protocol
- ActiveX scripting (ASCOM) in which commands are sent to the DDWCP using standard Microsoft scripting formats.

For example, we may have three control programs for a telescope, CCD camera, and an observatory, all running simultaneously under Windows. However, to function properly, some of these programs need information from the others. For example, the dome control program needs the desired dome azimuth data from the telescope control program to allow the dome seamlessly to follow the telescope, while the telescope control program needs to know if the dome is functioning properly.

This appendix describes the formats for these two methods.

Appendix 6.1 RCA File Protocol

The proposed protocol has a specific mission and is intended to be simple and easy to support. For that reason, its implementation is also simplistic, and consequently not appropriate for strict real-time control. We consider its primary use to be the communication of key observatory/telescope/ccd parameters between applications employing those devices in concert. For example, an automated observing system will have a scheduler program which will send commands to operate the observatory, align the telescope and expose pictures on the CCD. The authors of the observing system won't want to get bogged down in the details of managing all the pieces of equipment, they have their own requirements to meet. Consequently, this protocol offers a simplistic interface to the hardware- it is not intended to be thorough but only sufficient.

The interface consists of a subdirectory (could be shared across a network) or just local, its precise location and attributes have no significance other than requiring the host file system to support multi-user share type file access and standard read/write/create/delete capabilities. Both the filesystem's shared directory and all systems mounting/mapping it should have reasonably fast and reliable file manipulation capabilities.

The interface assumes a control program for each hardware item that participates in the protocol. Normally, this will be the vendor-supplied control program suitably modified to use this protocol. The control programs need not be aware of the other hardware, but if the telescope program is interested in observatory information, the protocol is the means by which the information is retrieved. A program does not have to support or interact with all files, but only those of interest to it. A system of programs will still function even if only some of the programs follow this protocol.

There are three types of files in the protocol:

- Output File-each control program write its data to its own output file which can be read by other programs
- Command File-any program may write commands to one or more command files which are read and acted upon by the target control program(s).
- Stop File-any program may write an emergency stop order which is read and acted upon by all programs involving physical movement.

Output Files

The mechanism is as follows; at some appropriate frequency (as suggested below or as determined by the vendor of the control program), each control program will generate an ASCII formatted dump of hardware status into a predetermined filename located in the shared directory- termed the "output file". A list of standard output file data formats follows this discussion. The frequency is a tradeoff between minimizing the age of the file's data and needless updating. The control program may also choose to update with different frequencies at different times. The minimum requirement is the file must be updated "reasonably" frequently. Each control program should provide some kind of setup mechanism allowing the user to specify to each program the precise location of the shared directory. The filenames should be "standard", that is, all observatories output to DOME.DAT, telescopes to SCOPE.DAT, and CCDs to CCD.DAT. Note that filenames longer than the "standard" 8.3 should not be used, as support should exist for file systems not capable of that feature. By implication, multiple devices of the same type will conflict, this is a design choice, as we are trying to implement a simple protocol which can immediately provide easy interoperation- it is not intended for universal support of all installations. Multiple devices of the same type might be addressed by having multiple shared directories, but that gets into more complicated housekeeping and will not be addressed here.

Because the presence of the output file indicates a particular device is present, when the control program starts, it should delete X.* the shared directory, where X is the name of the output file, and create its output file as soon as possible. Further, when the control program exits, it should delete X.* as well. In both cases, appropriate retries should be implemented and the .DAT file should be deleted FIRST. A control program should only delete the files for its device.

So, in the example scenario, we have three files being updated at arbitrary frequencies. If another program (or one of the control programs) becomes interested in the contents of another device's output file, it simply opens the file for shared read, reads all the data without pause, closes the file, and then acts on the retrieved information. Rapid closure of the file is key, as the file should not be held open longer than necessary. As this is a multi-user scenario, the probabilities of update or read failures are increased, as the various possible combinations of reading and writing indicate. The solution is a retry after a random wait, where the wait is $.5 \leq n \leq 3$ seconds, expressed in units of 100 milliseconds or less. After several retries fail, the program should revert to a safe condition (control programs stop motion, close the observatory, etc..) and if possible, signal its condition in its output file. Under no circumstances should a file read/write failure cause abends, infinite loops or any unexpected operation- at the very least the control program should fail gracefully. In general, it is up to the writer of the control program that is doing the reading to decide how to handle the absence of a needed X.DAT file; i.e., whether and how often to retry, whether to display an error message, whether automatically to recover from the error upon reappearance of the X.DAT file, etc.

This allows an arbitrary number of programs to retrieve information from whatever devices store data in the shared directory. Additional interfaces of this type, or other types between programs are not restricted by this standard, and additional devices can of course participate, and their output filenames should fit in with the intent of the standard. A vendor can of course use whatever filename they choose, but the intent is to provide interoperation to the simplest and maximum extent possible, so a generic "class" name is best in that context.

Command Files

The other half of the protocol allows a program to send commands to other control programs, causing them to "do" things, like open the dome or slew the telescope. Similar to the output file, the command protocol uses files in the shared directory. When a program wants to send a command, assume to the dome, it first scans the shared directory for DOME.DAT. If it is present and its contents show the dome hardware is ready, the program scans for DOME.CMD. If DOME.CMD is present, the observatory is busy with another command and the program should retry after random wait with appropriate logic to limit the process. If DOME.CMD is not present, the program can attempt to create and open the DOME.CMD file for exclusive write. If the create/open fails, another program has just sneaked in with its own command file, or there is some file system error, and in either case the program should retry appropriately. If the file is created and opens, the program will write its desired command and close the file. A list of standard commands follows this discussion. Other than polling for the CMD file to disappear, there is no further interaction and the device operation/status/result codes are retrieved normally from the output file as discussed

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previously. Obviously, “DOME” is replaced by the whatever name is appropriate for the desired hardware.

The control program must periodically scan the shared directory for its command file if it chooses to receive file commands. If a device cannot accept commands, it should simply delete the command file at the earliest opportunity. When it finds one, the file should be read and closed (but not deleted until after the command has been executed or failed). The command should be processed and executed as soon as possible, but can fail with appropriate codes issued in the output file. The command file should be deleted as soon as the hardware is ready to accept a new command. This implies hardware may still be in operation when the control program resumes looking for commands. The control program must be prepared to properly complete the command it accepted, and should fail any new commands which are inappropriate. However, commands such as Stop or Shutdown via the Command file should always be accepted and acted upon regardless of what command the control program or hardware is attempting to complete.

Stop Files

Independently from the command and data files, any program may issue an Emergency Stop signal by creating a file named “STOP.DAT” in the shared directory. The file’s contents are irrelevant and it may be zero length. When any program participating in this protocol detects this file, it should immediately and unilaterally stop all activity- leaving all hardware in whatever state it happens to be. All commands in progress should be terminated and command files deleted. All program modes should also revert to idle, but output files can continue to be updated. Under no circumstances should any hardware activity be initiated until STOP.DAT disappears. Automatic hardware failsafes should be continue to operate as configured. The file should not be deleted by any program, instead it is left to the user to delete it by hand. Once it does go away, all programs should prepare for normal operation. The polling interval for this file should be no longer than 5 seconds.

All Command files written while STOP.DAT should be processed and deleted but all commands which would cause hardware activity should be failed.

As noted above, the Stop file is intended to to stop all motion initiated by programs following the protocol. Because the mere presence of the STOP.DAT file is taken as the command to stop, contents of the STOP.DAT file are irrelevant. However, it is desirable to identify the source and reason for the STOP.DAT command by something like the following:

DATE=mm/dd/yyyy	as known to the control program
TextStatus=	A string describing why the stop was asserted.

ProductName=xxxxxxxn	xx is ascii text length <= 60, no whitespace and n is an integer version number <= 1000; it is intended to show the product and version, allowing use of extended functions as provided by the vendor
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Output file entries

File entries can appear in any order. Entries are of the form TEXTID=DATA where TEXTID is a text giving the name of the data, and DATA is the actual data in the proper format.

General comments on output file entries:

All labels are case-insensitive. All data values are case-insensitive except where explicitly noted. By definition, the first equal sign in the line is the label/data delimiter. The data field may contain any number of equal signs. Whitespace (spaces and/or tabs) may be added around the equal sign operator, but the data field formats should be treated strictly. "Client" programs must be prepared to handle arbitrary whitespace. A particular label with data can occupy only 1 line and the total length (excluding CR/LF) must be 78 chars or less. All lines must be terminated with a CR/LF.

When a control program overwrites the output file, all defined entries should be written, even when not appropriate to the device's condition. A control program may choose to add unlimited additional entries, but the standard entries should always be supported.

Following is a basic set of data that should normally be written to any program output file:

DATE=mm/dd/yyyy	as known to the control program, not required to be updated every second
TIME=hh:mm:ss.mmm	seconds and milliseconds are optional, 24 hr local time
Status=Ready,Busy,Unavailable,Shutdown	choose one
TextStatus=free text to end of line	control's program statement on what the hardware status is
LastResult=Success,Failure	result of last hardware operation attempted
ProductName=xxxxxxxn	xx is ascii text length <= 60, no whitespace and n is an integer version number <= 1000; it is intended to show the product and version, allowing use of extended functions as provided by the vendor

Status codes indicate the following:

Ready - Hardware is functional and waiting for a command. Doesn't necessarily mean no movement or activity is taking place; only that it is prepared to accept commands.

Busy - Hardware is executing a command.

Unavailable - Hardware is online, but is not busy and cannot accept a command at this time. This is intended to allow for non-fatal pause states; ie the access door in a dome is open which would prevent safe operation. When the condition is cleared, status reverts to Ready.

Shutdown - Hardware offline, but the control program is still running. In this state, the device is unavailable until the Startup command is processed (see below).

Any files exchanges performed by programs via this protocol should occur via defined subdirectories under the shared directory. If this is done, the only notation necessary to exchange files is the subdirectory and filename. Since each program knows the absolute path to the shared directory, it is trivial to append the supplied subdirectory and filename to obtain a complete pathname. This standard does not define any mechanism to support file exchanges, so they are considered vendor-specific features.

Additional entries for SCOPE.DAT

ScopeRA=hh:mm:ss	hours, minutes and seconds- zero pad each value appropriately
ScopeDec=+/-dd:mm:ss	degrees, minutes, seconds- zero pad each value appropriately, +/- are mutually exclusive
DesiredObservatoryAzimuth=ddd:mm:ss	dome azimuth which the telescope needs for unobstructed sight
GEMountScopeSide=EAST, WEST	For GE mounts, supply east orientation or west. East if scope is on east side of mount, west if on west. Omit for non-GE mounts, or if unknown.
IsTracking=Yes, No	choose one
IsSlewing=Yes, No	choose one

- The telescope control program supplies at least the ScopeRA and ScopeDec. The DesiredObservatoryAzimuth is optional, but if known, it should be supplied. To facilitate more accurate calculation of desired dome azimuth from RA/DEC, the GEMontScopeSide entry is very useful. If this value is not supplied in a GE scenario, the user will have to manually select the orientation in the Dome control software.

Additional entries for CCD.DAT

(these are entirely arbitrary- there is no intent to specify or control CCD in this proposal, this is included for illustrative purposes only)

FilterSetting=	Whatever this is
ExposureTimeRemaining=hh:mm:ss	time format, zero pad appropriately
IsExposing=Yes,No	
IsSavingExposure=Yes,No	

Additional entries for DOME.DAT

DomeAz=ddd:mm:ss	Dome opening azimuth, zero padded. mm and ss are optional. The preceeding colon and all subsequent text should be ommitted when mm and/or ss are not supplied. The degrees entry must always be supplied. Non-integer degree components are not allowed.
ShutterPosition=0 thru 100	Percent open, 0=closed
IsSlewing=Yes,No	
IsSlavedToScope=Yes/No	Indicates if the observatory control program is polling SCOPE.DAT for telescope alignment data. If Yes, the observatory control software will silently reject all GotoAz commands.

Command file entries

Only the first nonempty, nonblank line of a Command File is read by a program, and only one command can exist on a line. There is a set of commands accepted by all devices capable of executing user commands:

General comments on command file entries:

All commands are case-insensitive except as defined by the vendor. Any number of additional commands may be defined, but the standard set should be supported. Although any amount of data could be added to the command file, this standard indicates that only the first nonblank,notempty line is processed for commands. Its length not including CR/LF should be 78 characters or less. Leading or trailing whitespace is trimmed before processing.

Stop	Stops all motion
Shutdown	stop all motion, close/turn off/disable hardware and accept no hardware commands until Startup

Startup	Recover from Shutdown to normal operating mode
Restart	Reinitialize control program as if it were exited and restarted. This is an optional standard command.
Reset	Reset/reconfigure/re-align hardware as appropriate back to a "default", ready condition

Additional commands accepted by Telescopes
<to be defined>>

Additional commands accepted by CCDs
<to be defined>>

Additional commands accepted by Domes

Shutter open	open the shutter/door. If no shutter present, succeed immediately
Shutter close	do the opposite
Home	Causes DDW to rotate the observatory to the Home Position.
Slave on	Enables Slave mode in accordance with DDWCP's Configuration settings.
Slave off	Conversely, turns it off
Gotoaz=AZ:ddd:mm:ss	slew dome to degrees, minutes or seconds. mm:ss may be omitted.

- Note there are 2 cases of the GotoAz command; - the first specifies the position via RA & DEC and the second in absolute azimuth. The observatory control program must maintain variables for the appropriate telescope and mount properties, and use them to compute the absolute azimuth from RA/DEC. It is the user's responsibility to obtain the correct values for the scope/mounting properties and supply them to the observatory control software.

Appendix 6.2 Active X Scripting Interface

This section describes the ActiveX controls available to the user. If you do not already have scripting skills, we recommend that you read the information available on the subject (eg., in Visual Basic manuals) and pursue the subject on the Internet. We particularly recommend use of the ASCOM site which provides information on applying scripting to astronomical activities.

In addition to the file interface, the Digital Dome Works Control Program (DDWCP) offers an ActiveX interface. The interface provides similar remote control features:

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functions that rotate the dome, open and close the shutter, and retrieve status information. It provides a relatively simple means of integrating with various other applications which need to control the observatory. In a technical context, it allows any Windows programming language or application capable of producing ActiveX objects to connect to DDWCP and interact with the observatory. To exploit the interface, DDWCP must be installed on the host PC. It has been tested only in Windows 95 at this time, however it uses standard Microsoft controls and features, so is likely to run under most circumstances. (It must be noted, however, that ActiveX is a complex and fast-changing Windows subsystem. Therefore, idiosyncratic behavior is possible, and it may be that future ActiveX implementations will differ in some important details. For information about using ActiveX controls, see Microsoft's page at <http://www.microsoft.com/com/tech/ActiveX.asp> . Another site that contains a lot of links that may be useful is <http://www.shorrock.u-net.com/activex.html> .)

At the current time we do not foresee a substantial change to the interface itself, although bug fixes and enhancements to the DDWCP internals continue.

Although we retain the copyrights to the client software, Technical Innovations releases all our client software (including DDWCP) as Open Source via the GNU GPL, so all parties are free to use it. There is no significant impediment to a third party taking the source and modifying it to their exclusive advantage. However we hope any interested people will act in the spirit intended and share their updates with us.

Interface Specification

The TI Digital Dome Works software exposes an ActiveX interface. The interface consists of two parts: DomeControl and WeatherInfo. DomeControl is discussed here. Generally, the software is best invoked by the following code or something analogous:

```
Dim glDDW As Object
Set glDDW = CreateObject("TIDigitalDomeWorks.DomeControl")

Do While glDDW.statIsBusy()
    DoEvents
Loop
If glDDW.statIsOnline() Then
    debug.Print "DDW is Online"
Else
    debug.Print "DDW is not running."
Endif
```

This causes an instance of the Digital Dome Works Control Program (DDWCP) to be started, and allocates a representative object in the client software's variable space. Creating the object immediately starts DDWCP, which attempts to connect to the Digital Dome Works (DDW) hardware. Depending on various conditions it may take a few moments to complete the connection. Since `CreateObject` always succeeds, the do-while loop allows the client program to wait until DDWCP has successfully connected or not. Once `statIsBusy()` is false, `statIsOnline()` will indicate if DDW is online. If `statIsOnline()` returns false, the client may choose to retry via `actRefreshStatus()` which attempts to fetch status information from DDW.

glDDW can be global or local, but should only be freed when the client no longer needs access to the dome. The design of the client software should consider how the dome is shut down. Specifically, client software should not exit without providing an option to close the dome and park the scope. Well-designed client software should ensure the observatory is closed, scope parked and other equipment turned off or left in an idle mode. DDW has interlocks intended at least to prevent the dome from being left open, but client software should explicitly address the issue.

Each member's name leads off with a short mnemonic representing the class of function; those starting with 'act' cause the DDW to do things, 'stat' returns status information, 'pos' returns information about the position of the dome (azimuth/shutter).

Most function entries return either an integer or boolean, but several return double floats. For the numeric functions, a return value of -1 usually indicates the (DDW) hardware is not available (busy, turned off or disconnected). Otherwise, they return a value ≥ 0 . Movement related 'act' functions return only -1, 0 or 1; 1 represents success, 0 for failure or operation in progress. For those functions that return a boolean value, true means the assertion is true (`statIsShutterOpen()` returning true means the shutter is fully open). But false doesn't necessarily mean the assertion is false, as an offline condition also causes false to be returned. The client should include `statIsOnline()` tests at appropriate points to insure false returns are acted upon correctly. Thus, if `statIsOnline()` is true and `statIsShutterOpen()` is false, the client should conclude that the shutter is in some position other than full open. Furthermore, if `statIsShutterClosed()` is also false, the client should conclude the shutter is neither fully open or fully closed- and therefore somewhere in between. However, if `statIsOnline()` is false, the client cannot conclude anything about the shutter position because the DDW hardware is offline.

Action functions directed towards moving the dome or shutter support two different modes of operation; blocking and non-blocking. Blocking mode means the function will not return until the action has finished with success or failure. Non-blocking means the function will return immediately after DDW has accepted and started the command. In non-blocking mode, the client software is responsible for keeping track of what's going on and submitting subsequent commands only when DDW is not busy. Non-blocking mode is well suited for "real-time" status displays. The 'stat' entries are continuously updated while operations are in progress, so the latest information is always available. Since 'stat' functions only return the most recently retrieved status information, they are quite efficient.

The DDWCP ActiveX interface may be configured to always assert exceptions when errors & problems occur, or only return an error code. Different people choose to handle errors differently, so we leave the choice to the user. To make DDWCP generate exceptions, set the `optAssertErrObjects` member to True, setting it to False causes DDWCP to never assert exceptions, returning error codes instead.

Shown below are the functions and variables exposed by DDWCP for use by client software. They are referenced in the normal way, e.g.:

```
glDDW.optCommandBlockingMode = True
```

or

```
if glDDW.actCloseShutter() = 1 then
    debug.print "shutter closed"
endif
```

DomeControl Members:

actCloseShutter% () - Attempts to close the dome. Succeeds if the dome is already closed. If the dome is not at home, sending this command will cause it to be rotated home before the shutter is closed.

actOpenShutter% () - same as `actCloseShutter` except for opening.

actGoHome% () - Causes the DDW to rotate the dome to the home position, either clockwise or counter-clockwise (whichever offers the smallest rotation.)

actGotoAzimuth% (byval az%) - Attempts to rotate dome to a particular azimuth relative to north (0 degrees), with degrees incrementing clockwise looking down on the dome from above. Az must range from 0 to 359. DDW will select the direction which requires the minimum rotation.

actTrainDome% () - Causes the DDW to perform a full dome rotation, to learn the dome circumference in encoder ticks, and the clockwise distance in ticks from north to the dome door. Therefore, the dome should be manually rotated to point north BEFORE training is initiated. This command is only needed when the dome's rotation/azimuth properties are changed (new encoders, different sized dome, rotation of dome base, movement of shutter contacts) .

actParkScope% () - causes the DDW hardware to park a Meade LX-200 or compatible scope. Park is defined as switching the slew rate to sidereal and starting slewing to the east, thus leaving the scope stationary with no motors running. Some scope hardware allows the scope to be turned off without losing position information. Consult your scope manuals for details. The park will only occur if the LX-200 or compatible is connected to DDW via the scope's aux port.

actUnparkScope% () - causes DDW to unpark the scope by switching the tracking speed to guide rate and tracking west.

actStopParkTimeout% () - Disables a four-minute timer that DDW decrements to zero before automatically sending an automatic scope park. This timeout is reset whenever a dome movement command is sent (even if no hardware movement actually occurred). Info queries DO NOT restart the timer. The automatic scope park only occurs if the scope is not slaved, the dome is home and the shutter is closed. If a LX-200 or compatible scope is not connected to the DDW unit, the timeout and subsequent command have no effect. All automatic scope park commands may be disabled by turning off the Automatic ScopePark DIP switch on the DDW system board. If this is done, aux port slaving will still work, but DDW will never send a scope park unless the user sends an explicit scope park/unpark command.

actStop% () - Causes the DDWCP to send a stop signal to the DDW at the next opportunity while in the middle of a movement related action command. This command has no effect upon the DDW manual controls or the Slave flag. Depending upon the implementation of the client software and the details of Microsoft's ActiveX subsystem, client software may or may not be able to issue an `actStop ()` while in the midst of a blocking mode command- however if it can and does, DDWCP will act upon the stop. An `actStop ()` asserted while no activity is occurring will have no effect.

actUserPins% (byval pins%) - sends a bit pattern to DDW specifying which user pins should be turned off and on. 1 bits turn on outputs, 0 bits turn them off. Returns 1 if the pins were set, -1 if DDW is unavailable.

actRefreshStatus () as Boolean - Queries DDW for new status information. Returns false if DDW is not available. If it returns true, status values may be retrieved from the various status related functions. DDW does this automatically every 100 seconds.

firmwareVersion% () - returns the DDW firmware version. Commands and their semantics may change between firmware versions of DDW. The return value of this function should be used to route client logic accordingly. The current production version of DDW is 2, and is not expected to change in the foreseeable future. Some version 1 hardware is in use at this time, and supports everything illustrated here with the exception of the automatic scope park features.

optCommandBlockingMode as Boolean - is a get/set boolean variable that selects blocking (true) or non-blocking mode (false) for all action related functions. Blocking mode causes the action functions not to return until the operation has succeeded or failed. Non-blocking mode causes action functions to return immediately once the

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command is submitted to DDW. If in non-blocking mode, the client program is responsible for monitoring the operation's status.

optSlaveMode as Boolean - is a get/set variable, set to true if DDW should slave itself to the scope, false if not. Automatically set to false if any action commands (or manual operations) are initiated. Depending upon the SlaveType selected, toggling this value may precipitate communications to the DDW. This happens invisibly, but will entail DDW going busy for some moments after optSlaveMode is changed.

posDomeAzimuth# () - Returns the dome azimuth in degrees. Fractional values are the fraction of a single degree (not minutes or seconds). The azimuth value is not rounded in any way, so the client should ensure proper treatment in whatever manner suits.

posDomeShutterPctOpen# () - returns a percentage between 0 and 1 indicating the estimated shutter position. 1 means full open, 0 is closed. The Percent Open value returned is not rounded in any way, so the client should ensure proper treatment in whatever manner suits. This value is automatically set to 50% if DDW is unaware of the shutter position (for example, because of a power up away from home azimuth). Because there is no encoder reading the absolute shutter position, DDW estimates the position by sending simulated shutter encoder ticks whenever the shutter is moving. This works well enough for full-open and full-close operations because the duration of shutter movement is more or less the same. However, if the shutter movement is interrupted, DDW has no idea where it actually stopped. Therefore, the shutter position value should not be given the same confidence as the dome azimuth value (which is based on an encoder).

statDomeDoor% () - returns the status of the dome door: 0=undefined, 1=closed, 2=open. Undefined is returned when the DDW is not aware of the status of the door, which is typically only the case when the device is first turned on.

statIsDomeDoorClosed() as Boolean - true if door is closed, false if not, or if DDW is unavailable.

statIsDomeDoorOpen() as Boolean - true if door is open, false if not, or if DDW is unavailable.

statDomeIsHome() as Boolean - true if dome is at home azimuth (door lined up with shutter and shutter contacts connecting to their respective wipers), false if not, or if DDW is unavailable.

statGetSlaveType% () - returns the source of telescope position information used when slaving is enabled. At the current time, the slave type is only adjustable via the Configure dialogs of DDWCP itself.

SLAVETYPE_DC3ACP = 4 - RA/DEC is retrieved from R.Denny's ACP program.

SLAVETYPE_RCASCOPEFILE = 1 - RA/DEC from SCOPE.DAT as indicated by the RCA specs.

SLAVETYPE_THESKYSCOPEFILE = 2 - RA/DEC from Software Bisque's TheSKY software scope file.

SLAVETYPE_LX200AUXPORT = 3 - scope azimuth retrieved directly from the aux port of a LX-200 or compatible telescope. If DDW is not connected to a scope, this option won't produce any dome movement.

SLAVETYPE_NONE = 0 - if no scope info source is specified.

statGetUserPins(adc1%, adc2%, pinval%) as Boolean - sets byref parameters to the user adc input values and user I/O pins. Returns true if values were retrieved and stored into parameters, false if not.

statIsBusy() as Boolean - returns true if DDW is busy doing something, false if not or DDW unavailable.

statIsInScopeParkTimeout() as Boolean - true if the four-minute scope auto-park timeout has begun counting. If the auto-park is disabled via dip-switch setting, this function always returns false.

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statIsOnline() as **Boolean** - true if DDW is on, false if not. Does not indicate readiness for commands, only that the hardware is online.

statIsShutdown() as **Boolean** - true if dome is rotated to home and the shutter closed, false if not, or if DDW offline.

statIsShutterClosed() as **Boolean** - true if shutter is closed, false if not, or if DDW offline.

statIsShutterOpen() as **Boolean** - true if shutter is fully open, false if not, or if DDW offline.

Appendix 7 Parts List

ITEM	DESC	QUAN 6/10/15*
DDW Controller	Steel case, pcb, (4) 1/4-20x3/4 carriage bolts	1
Hand Controller	Five button (Mod 2)	1
Azimuth Sensor	Sensor assembly, with (2) 1/4-20x1 carriage bolts	1
End of Travel Reed Switch Assy	Open Magnet (strong) w/mounting plate, 6-32/3/4 screws and Reed Sw, 6-32x3/4 screws	1 set
	Closed Magnet (strong) and Reed Sw, 6-32x3/4 screws	1 set
	Shutter Relay Box, 1/4-20x1/2, w/3 ft #14 wire w/term,	1
DSR Interlock Assembly	Magnet, Sensor	1 set
#22 two conductor wire	Use for sensor, entry switch, and DSR Interlock signal wiring (NOT for power wiring)	16/24/32
#14 two conductor wire	Spade terminals, 3 ft (used for power wiring)	1
Telephone Cable, 6 conductor	With RJ14 connectors, 10 ft.	6
PC1 Adapter (small)	PC serial to DDW, PC serial to LX200 Adapter	2
LX200 Adapter box	Combines Serial from PC and DDW into LX200	1
Capacitors for DC motors	1 each motor – only if requested by customer	3/3/6
Entry Switch Assembly	Switch, pilot light	1 set
DDW Install Disks/CD	WIN95/98/NT/XP/Vista	1 set
Instruction Manual		1

*Quantities for different dome diameters

Note: Adapter labeled PC1 (formerly called SBC/single board computer) adapts our standard “Gray”, 6 conductor RS232 cable to the DB9 serial connector on a PC. USB-to-Serial adapters and hubs can be used. LX200 adapter box connects a PC to an LX200 (Meade cables do not follow our standard colors)

Appendix 8 List of Figures

Fig#	Title	File Name	
	Use of Two Channel LX200 (LX200 Adapter)	DDW3e	
	Magnetic Sensors for End of Travel	DDW8	
	Shutter Relay-Mod 1	SHUTRLY1	
	DSR Interlock	DDW4	
	German Eq Settings for Rem Ctrl Ast	DDW9	
	Digital Dome Works DDW3 schematic	DDW3V6	
	Adapters, Terminals, Wire Color Conventions	DDW10	

ITEM			

Appendix 9 New DDW Features & Instruction Manual Changes

Although written for DDWV4, this instruction manual can be used for DDW versions V2 and later as they are functionally very similar. This appendix describes the various versions, and provides a detailed list of changes after the first issuance of this V4 instruction manual.

The following list the major features of the DDW versions. However, within each version, there were many minor electronic and functional improvements.

- Model 1. This version used a Basic Stamp as the processor, and had substantial hand wiring and three open relays. Basic functions were the same as later versions, but there are many variations due to the limited capability of the processor
- Model 2. This version made the first switch to a larger processor. All basic logic is the same as later versions; however, there was still substantial hand wiring and open relays.
- Model 3. This version is the most prevalent. It had virtually no hand wiring, and featured enclosed relays.
- Model 4. This version number applies to those units which meet all of these conditions.
 - ◆ DDW board version DDWV3V15 or later (number next to mode switch)
 - ◆ DDW processor dated after 111201
 - ◆ DDWCP V4 software (dated after 11/12/01) in the control PC

New Board

The new board type is Version DDW3V15 and higher as marked on the board in the lower center of the board and has been shipped since Spring 2001. The new boards have an integrated circuit on the board to the left of the main processor, while the old boards have several transistors in that area. The new boards also have an additional connection jack at the upper left labeled I-L (for interlock). We are continuing to make many minor changes in the board layout to improve spacing, ease of construction, etc.

We have made the following significant changes in the board electronics:

- We are providing a new ESC chip called ESC4. This is the chip that controls the details of the motor startup and running. The new ESC4 chip includes an internal timer that stops any motion (rotation or shutter) that has continued for more than ten minutes. The timer is reset by turning the DDW off/on. At this time, there is no indicator LED or control notification of the operation of this interlock. This protects against uncontrolled rotation (e.g., rain water in hand control, etc.)
- Removed most of the discrete transistor switches and replaced them with a single integrated circuit.
- Removed the two user input ADC channels (very few people were using them). We have added two additional switched output channels for a total of four. This will allow user control of four independent remote control power channels with optional remote power module. The old two channel remote power module will still work. If you have a new board and still want to use the ADC channels contact us for instructions.
- Provided a new Interlock jack allowing easier access to certain functions. These include access to heartbeat and slave which will allow remote hardware sensing of DDW and dome status. We are also making available a remote/automatic computer reboot when the dome closes as a result of a crashed control computer (requires optional reboot module).

- Fixed bug in circuit of external slave terminal

Model 4 DDW Chip

The DDW chip to support Model 4 functions is dated 11/12/01 or later and can be installed by the user. Changes to the DDW processor firmware include:

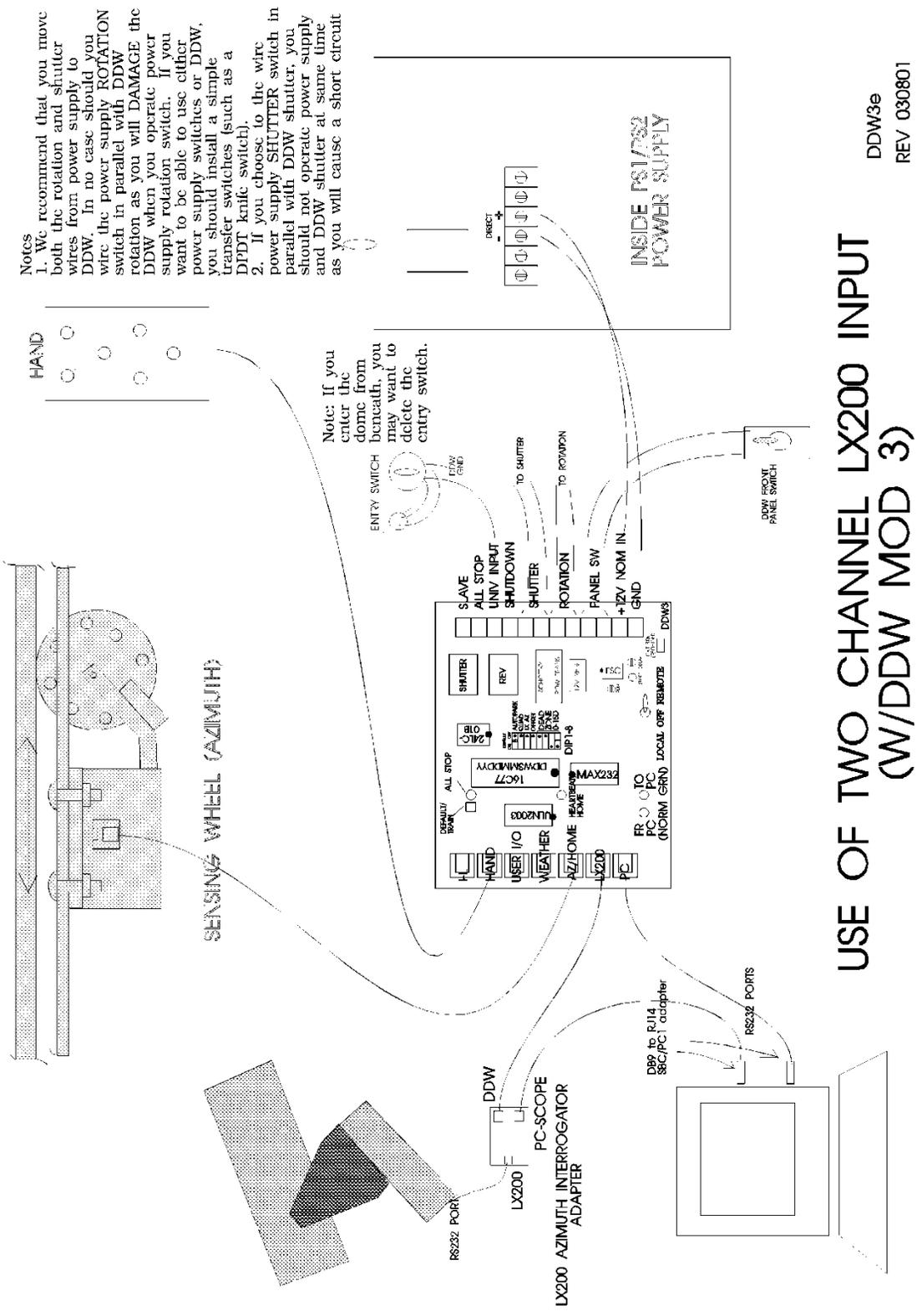
- When going home, will stop close to the middle of the sliding contacts (if coast is shorter than Home). Formerly would stop at the first point touched, making ProDome door opening sometimes difficult.
- If the dome goes home but coasts past the end of the contacts, the dome will “bump” intelligently up to ten times in reverse to regain home. First move after passing home is another in the same direction to calibrate short pulse coasting, then will reverse and go back and forth to try to stop on home. Moves are direction biased slightly to help hit home. This is useful for non-TI domes having laong coast distances.
- Support for automatic reboot (if PC locks up, DDWCP refresh ceases, DDW closes dome triggering relay to reboot computer). Call for details if you are interested in this. Not available on old boards.
- Alarm sounds for all shutter closing conditions (not just when remotely commanded)
- Conversion to four remote control channels (delete two user ADC inputs). Not available on old boards.
- Increase from four to eight minutes for auto shut on com failure (makes it easier to take action)
- AZ sensing has modified logic to prevent dome rocking during wind from tripping slaving off. This change does remove the ability of the DDW to sense rotation of the dome performed outside DDW if in non quad mode (DIP7 off).
- Unless a Stop command is issued, all shutter closure commands are executed five times (not just on self initiated closing) to assure full closure
- Increase averaging time on motor current readings and increased threshold to reduce chance of incorrectly detecting end of travel
- When training rotation, now requires at least 10 ticks after first home detection before next home detection (reduces training problems, especially with poor contacts).
- DDW now issues three quick beeps just before starting a commanded rotation (to avoid sudden dome movement from startling the observer)
- Repair of subtle bug in home measurement code
- Shorter cycle time to improve responsiveness, while still handling non-quad direction change properly
- Modified heartbeat pattern to show home and shutter closed (99%on), home and shutter open(80% on), and not home (10% on) (now distinguishes shutter open vs. closed status).
- Finer slaving and GOTO movements. In the past, GOTO commands that are smaller than the full speed coast (determined at training) will be ignored. The new version provides a short pulse (about 0.1 sec) after each GOTO command (or commanded slave movement) to nudge the dome toward the correct location. This improves slave precision and GOTO for domes with large coast values.
- Weather data processing to support average and peak wind and modified data lifetime logic, as discussed below

- Modify stop logic to require at least two characters (was one) to trigger a stop (reduces incorrect stop actions, especially with custom control software or noisy comm lines)
- Modified Fast Track data packet to provide faster cycle rates.

Version 5.1 DDWCP

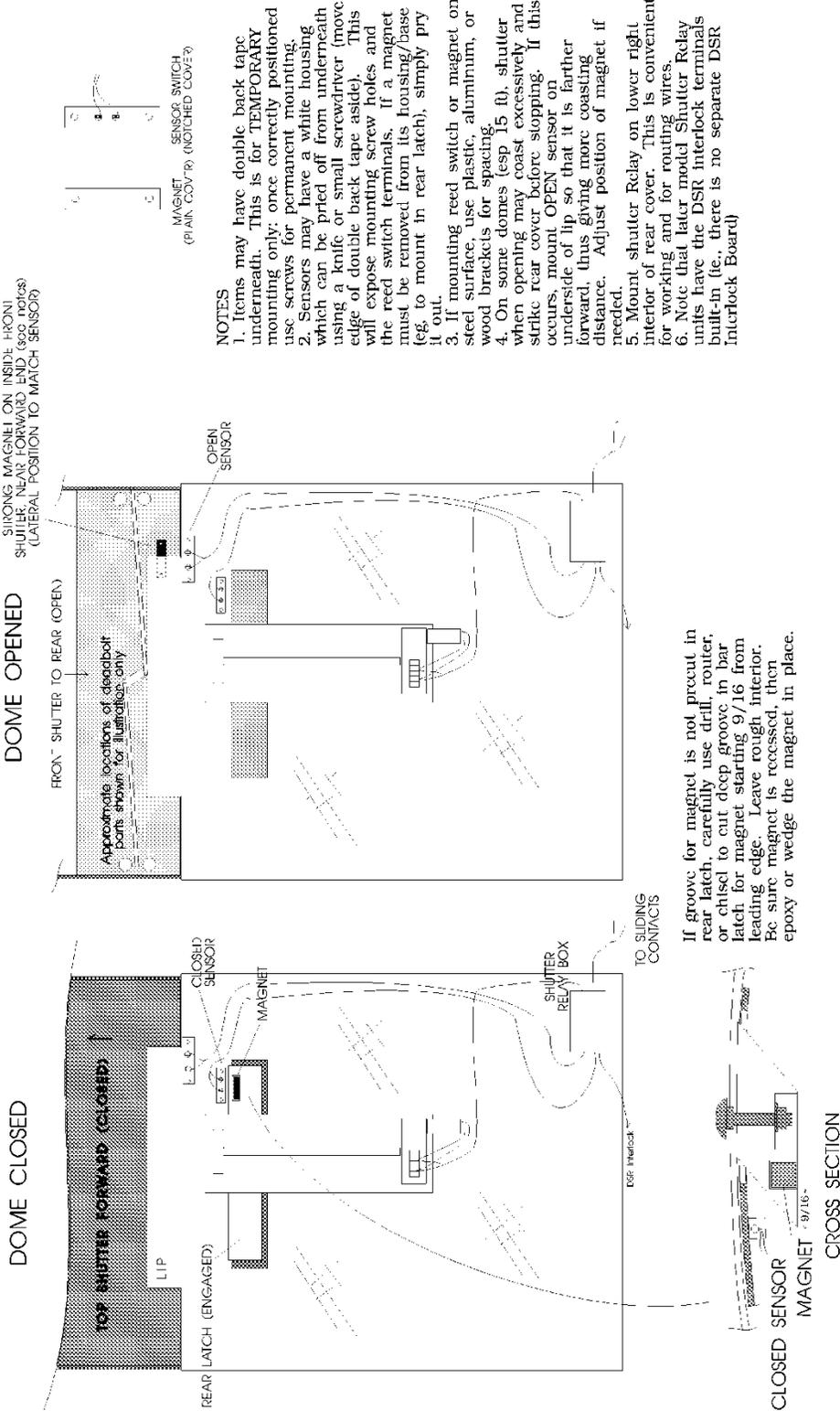
The new version 5.1 control software is dated 11/30/07. You can see the date of your program in the ABOUT menu item. Changes to DDW Control Program include:

- Support for Davis Vantage Pro Weather Station and Boltwood Cloud detection system
- Showing reduced main display screen with option to remain on top of Desk Top
- Ability to establish multiple scope configurations inside the dome, with individual offsets for each
- Ability to perform weather interlocks based upon inputs from either Davis Vantage Pro, Boltwood Cloud detector or both at the same time. Includes option to warn before auto closure.
- More consistent shutter and rotation display screen.
- Automatically updates Daylight Savings Time changes (from computer clock)
- User controlled pause feature with weather interlocks (except rain)
- Dome “cool down” feature by directing shutter slit into wind upon opening.
- Enhancements to ACP interface.
- Fixed bugs in the GEM over/under axis designation.
- Added additional support for Paramount ME.
- Enhancements of User Pin operation



DDW3e
REV 030801

IEWS OF DOME LOOKING
UP INSIDE
(BLUE SIDE)

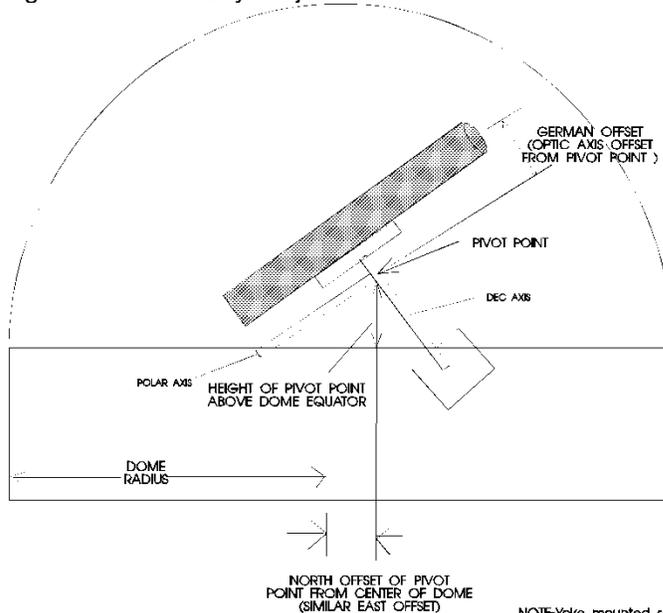


- NOTES**
1. Items may have double back tape underneath. This is for **TEMPORARY** mounting only; once correctly positioned use screws for permanent mounting.
 2. Sensors may have a white housing which can be pried off from underneath using a knife or small screwdriver (move edge of double back tape aside). This will expose mounting screw holes and the reed switch terminals. If a magnet must be removed from its housing/base (eg. to mount in rear latch), simply pry it out.
 3. If mounting reed switch or magnet on steel surface, use plastic, aluminum, or wood brackets for spacing.
 4. On some domes (esp 15 ft. shutter when opening may coast excessively and strike rear cover before stopping. If this occurs, mount OPEN sensor on underside of lip so that it is farther forward, thus giving more coasting distance. Adjust position of magnet if needed.
 5. Mount shutter Relay on lower right interior of rear cover. This is convenient for working and for routing wires.
 6. Note that later model Shutter Relay units have the DSR interlock terminals built-in (ie., there is no separate DSR Interlock Board)

If groove for magnet is not present in rear latch, carefully use drill, router, or chisel to cut deep groove in bar latch for magnet starting 9/16 from leading edge. Leave rough interior. Be sure magnet is recessed, then epoxy or wedge the magnet in place.

Magnetic Sensors for
End of Travel

DDW8
113001



NOTE-Yoke mounted scopes have similar dimensions relative to the pivot point. Yoke mount German offset value normally equals zero.

GERMAN EQUATORIAL SETTINGS FOR REMOTE CONTROL ASTRONOMY

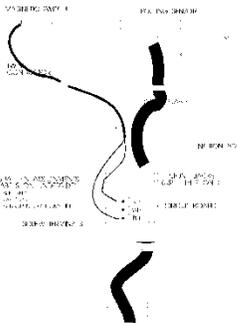
DDW9

111098

German Equatorial Settings



MOTOR ELECTRICAL NOISE FILTER CAPACITOR INSTALLATION



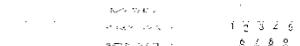
SHUTTER OPEN/SHUTTER POS. SENSOR BOX
HOME/AZ SENSOR BOX



WIRE, PLUG, & JACK COLOR CONVENTIONS



LX200 SERIAL CONNECTION PC SERIAL CONNECTION DB9 FEMALE SOLDER SIDE



PC1/SBC SERIAL CONNECTION PC SERIAL CONNECTION DB9 FEMALE SOLDER SIDE



TO DDW MOD1
TO PC
LX200 AZIMUTH INTERROGATOR ADAPTER

DB9 FEMALE

ORANGE	CHASSIS JACK	GREEN	PC1/SBC GND
RED	PLUS	RED	PC1/SBC +5V
GREEN	PC1/SBC GND	GREEN	PC1/SBC GND
BLUE	PC1/SBC +5V	BLUE	PC1/SBC +5V
BROWN	PC1/SBC +5V	BROWN	PC1/SBC +5V
BLACK	PC1/SBC +5V	BLACK	PC1/SBC +5V
WHITE	PC1/SBC +5V	WHITE	PC1/SBC +5V

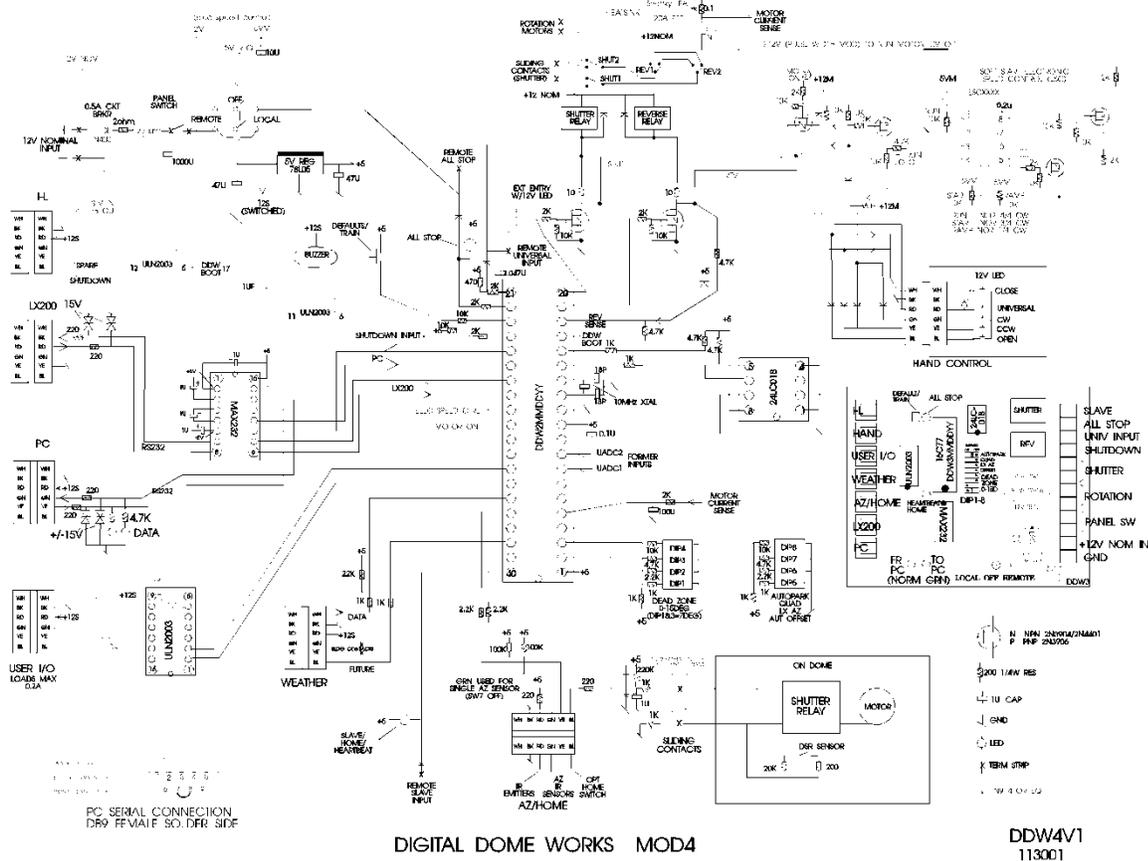


AP GOTO MOUNT SERIAL CONNECTION

ADAPTERS, TERMINAL & WIRE COLOR CONVENTIONS

REV 04250 DDW10

Adapters, terminal, and Wire Color Conventions



DIGITAL DOME WORKS MOD4

DDW4V1
113001

Digital Dome Works Schematic

26 05 13 – CONDUCTORS & CABLE

PART 1 GENERAL

1.1 REGULATORY REQUIREMENTS

- A. Conform to NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories Inc. As suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: NFPA 70; Type THW insulation for feeders and branch circuits larger than 4/0 AWG; Type THHN/THWN insulation for all others.

2.2 METAL CLAD CABLE

- A. Description: NFPA 70, Type MC.
- B. Conductor: Copper.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.
- C. Verify that raceway installation is complete and supported.

3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.3 WIRING METHODS

- A. Concealed Dry Interior Locations, Exposed Dry Interior Locations, Above Accessible Ceilings, Wet or Damp Interior Locations and Exterior Locations use only building wire, Type THHN/THWN insulation, in raceway.

3.4 INSTALLATION

- A. Route wire and cable as required to meet Project Conditions.
- B. Install cable in accordance with the NECA "Standard of Installation."
- C. Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- D. Use stranded conductors for control circuits and all motor connections.
- E. Use conductor not smaller than 12 AWG for power and lighting circuits.
- F. Use conductor not smaller than 14 AWG for control circuits.
- G. Pull all conductors into raceway at same time.
- H. Use suitable wire pulling lubricant for building wire.
- I. Protect exposed cable from damage.
- J. Support cables above accessible ceiling, using plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.
- K. Use suitable cable fittings and connectors.
- L. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- M. Clean conductor surfaces before installing lugs and connectors.
- N. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

- O. Identify all wire and cable. Identify each conductor with its circuit number or other designation indicated.

3.5 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NFPA 70 and applicable local codes.

END OF SECTION

26 05 83 – WIRING DEVICES

PART 1 GENERAL

1.1 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Provide Products listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 WALL SWITCHES

- A. Color: Stainless steel cover plate and grey device.
- B. Specification Grade.
- C. Manufacturers:
 - 1. **Single Pole Switch:**
 - a. Pass & Seymour Model 20 AC1-I.
 - 2. **Double Pole Switch:**
 - a. Pass & Seymour Model 20 AC2-I.
 - 3. **Three-way Switch:**
 - a. Pass & Seymour Model 20AC3-I.
 - 4. **Four-way Switch:**
 - a. Pass & Seymour Model 20AC4-I.
 - 5. **Indicator Switch Pilot Gang:**
 - a. Pass & Seymour Model 20AC1/3-CPL.
 - 6. **Key Switch:**
 - a. Pass & Seymour Model 20AC1/2/4-L.
 - 7. **Momentary Switch:**
 - a. Pass & Seymour Model 1250-I.

2.2 RECEPTACLES

- A. Color: Stainless steel cover plate and grey device.

- B. All devices to have 20A at 125V rating.
- C. Specification Grade.
- D. Manufacturers:
 - 1. **Single Convenience Receptacle:**
 - a. Pass & Seymour Model 5361
 - 2. **Duplex Convenience Receptacle:**
 - a. Pass & Seymour Model 5362.
 - 3. **GFCI Receptacle:**
 - a. Pass & Seymour Model 2091-S.
 - 4. **Isolated Ground Receptacle:**
 - a. Pass & Seymour Model IG6300.
 - 5. **Telephone Jack:**
 - a. Hubbell Model CX244.

2.3 WALL PLATES

- A. Decorative Cover Plate: Stainless steel.
- B. Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device cover.
- C. Shall be furnished and installed for the type of service involved.
- D. Manufacturers:
 - 1. **Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device cover.**
 - a. Hubbell Model WP826MP.

2.4 FLOOR MOUNTED SERVICE FITTINGS

- A. Flush Cover Convenience Receptacle:
 - 1. **Material: Brass plate with steel box.**
 - 2. **Configuration: Duplex threaded opening.**
 - 3. **Manufacturers: Hubbell Model 132529 W/SF2525.**

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that outlet boxes are installed at proper height.
- B. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify that floor boxes are adjusted properly.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 INSTALLATION

- A. Install in accordance with NECA "Standard of Installation."
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- E. Do not share neutral conductor on load side of dimmers.
- F. Install receptacles with grounding pole on bottom.
- G. Connect wiring device grounding terminal to outlet box with bonding jumper.
- H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- I. Connect wiring devices by wrapping conductor around screw terminal.
- J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- K. Install protective rings on active flush cover service fittings.

3.3 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

END OF SECTION

26 05 26 – GROUNDING & BONDING

PART 1 GENERAL

1.1 GROUNDING SYSTEM DESCRIPTION

Motor Frames.

Metal frame of the building.

Noncurrent-carrying metallic parts of electrical equipment.

Rod electrode.

Buried metallic water piping.

1.2 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 25 ohms maximum.

1.3 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70 and applicable local codes.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

Material: Copper-clad steel.

Diameter: 5/8 inch.

Length: 8 feet.

2.2 WIRE

Material: Stranded copper.

Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install rod electrodes at locations indicated.
- B. The minimum size of grounding conductors shall be in accordance NFPA 70 or local code requirements.

END OF SECTION

26 05 33 – RACEWAY & BOXES**PART 1 GENERAL****1.1 REGULATORY REQUIREMENTS**

- A. Conform to requirements of the National Electrical Code.
- B. Provide Products listed and classified by Underwriters Laboratories, Inc., or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS**2.1 CABINETS, BOXES, AND FITTINGS, GENERAL**

- A. Electrical Cabinets, Boxes, and Fittings: Of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations.

2.2 OUTLET, DEVICE, AND SMALL WIRING BOXES

- A. General: Conform to UL 514A, "Metallic Outlet Boxes, Electrical," and UL 514B, "Fittings for Conduit and Outlet Boxes." Boxes shall be of type, shape, size, and depth to suit each location and application.
- B. Steel Boxes: Conform to NEMA OS 1, "Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports." Boxes shall be sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.
- C. Service Fittings for Floor Outlet Boxes: Surface mounted horizontal, cast aluminum type 3 inches high, suitable for finished spaces and finished in satin aluminum, except as otherwise indicated. Provide duplex receptacle or 1 inch bushed opening for telephone or other communications service as indicated. Equip fitting for attaching flat to floor box cover.

2.3 PULL AND JUNCTION BOXES

- A. General: Comply with UL 50, "Electrical Cabinets and Boxes", for boxes over 100 cubic inches volume. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.
- B. Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.
- C. Hot-Dipped Galvanized Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing. Hot-dip galvanized after fabrication. Cover shall be gasketed.
- D. Boxes Approved for Classified Locations: Cast metal of cast nonmetallic boxes conforming to UL 886, "Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations," listed and labeled for use in the specific location classification, and with the specific hazardous material encountered. Conduit entrances shall be integral threaded type.
- E. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
 - 1. **Material: Cast aluminum.**
 - 2. **Cover: Nonskid cover with neoprene gasket and with suitable stainless steel cover screws.**
 - 3. **Cover Legend:**
- F. Fiberglass Handholes: Die molded glass fiber hand holes:
 - 1. **Cable Entrance: Pre-cut 6 inch x 6 inch cable entrance at center bottom of each side.**
 - 2. **Cover: Glass fiber weatherproof cover with nonskid finish.**

PART 3 EXECUTION

3.1 INSTALLATION OF OUTLET BOXES

- A. Install boxes in accordance with NEC "Standard of Installation."
- B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

- C. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
- D. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet if required to accommodate intended purpose.
- E. Orient boxes to accommodate wiring devices.
- F. Maintain headroom and present neat mechanical appearance.
- G. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- H. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- I. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- J. Locate outlet boxes to allow luminaries positioned as shown on reflected ceiling plan.
- K. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- L. Use flush mounting outlet box in finished areas.
- M. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- N. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.
- O. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- P. Use stamped steel bridges to fasten flush mounting outlet box between studs.

- Q. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- R. Use adjustable steel channel fasteners for hung ceiling outlet box.
- S. Do not fasten boxes to ceiling support wires.
- T. Support boxes independently of conduit.
- U. Use gang box where more than one device is mounted together. Do not use sectional box.
- V. Use gang box with plaster ring for single device outlets.
- W. Use cast outlet box in exterior locations [exposed to the weather] and wet locations.
- X. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.
- Y. Set floor boxes level.

3.2 INSTALLATION OF PULL AND JUNCTION BOXES

- A. **Box Selection:** For boxes in main feeder conduit runs, use sizes not smaller than 8 inches square by 4 inches deep. Do not exceed 6 entering and 6 leaving raceways in a single box. **Cable Supports:** Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30 inches inside boxes.
- B. Mount pull boxes in inaccessible ceilings with covers flush with the finished ceiling.
- C. **Size:** Provide pull and junction boxes for telephone, signal, and other systems at least 50 percent larger than would be required by Article 370 of NEC, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems.

END OF SECTION

26 05 53 – ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.1 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70 and applicable local codes.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 NAMEPLATES AND LABELS

- A. Nameplates: Engraved three-layer laminated plastic, black letters on white background.
- B. Locations:
 - 1. Each electrical distribution and control equipment enclosure.**
 - 2. Communication cabinets.**
 - 3. Starters.**
 - 4. Disconnect Switches.**
- C. Letter Size:
 - 1. 3/8-inch letters for identifying equipment.**
- D. Note: Embossed adhesive tape shall not be used.

2.2 WIRE MARKERS

- A. Description: Tubing type wire markers.
- B. Locations: Each conductor at panelboard gutters, pull boxes, and junction boxes and each load connection.
- C. Legend:

- 1. Power and Lighting Circuits: Branch circuit or feeder number indicated.**
- 2. Control Circuits: Control wire number indicated on shop drawings.**

2.3 UNDERGROUND WARNING TAPE

- A. Description: 2-inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.
- B. Location: Along length of each underground conduit.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.2 INSTALLATION

- A. Install nameplate parallel to equipment lines.
- B. Secure nameplate to equipment front using rivets.
- C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

END OF SECTION

26 05 83 – WIRING CONNECTIONS

PART 1 GENERAL

1.1 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70 and applicable local codes.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. for testing firm acceptable to the authority having jurisdiction, as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 CORDS AND CAPS

- A. Attachment Plug Construction: Conform to NEMA WD 1.
- B. Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
- C. Cord Construction: NFPA 70, Type SO multi-conductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
- D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.

- B. Make conduit connections to equipment using flexible conduit. Use liquid tight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

26 06 21 – ENCLOSED MOTOR CONTROLLERS

PART 1 GENERAL

1.1 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing enclosed motor controllers with minimum 3 years documented experience.
- B. Acceptable Manufacturers:
 - 1. **Square D.**
 - 2. **General Electric.**
 - 3. **Siemens.**
 - 4. **Cutler Hammer.**

1.2 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70 and NEMA ICSI, 2 and 6.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUAL CONTROLLERS

- A. All motor controllers shall have an overall unit short circuit current rating that equals or exceeds of maximum fault current at the point of application.
- B. Manual Motor Controller: NEMA ICS 6, AC general-purpose, Class A, manually operated, full-voltage controller with overload element, red pilot light, N.O. auxiliary contact, and push button operator.
- C. Fractional Horsepower Manual Controller: NEMA ICS 6, AC general-purpose, Class A, manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, red pilot light and toggle operator.

- D. Motor Starting Switch: NEMA ICS 2, AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, with red pilot light and toggle operator.
- E. Enclosure: NEMA ICS 6, Type as required to meet conditions of installation.

2.2 AUTOMATIC CONTROLLERS

- A. Magnetic Motor Controllers: NEMA ICS 6, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
- B. Coil operating voltage: 120 or 208 volts, 60 Hertz.
- C. Overload Relay: NEMA ICS; melting alloy.
- D. Enclosure: NEMA ICS 6, Type as required to meet conditions of installation.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Refer to Section 01 78 00 for manufacturer's instructions.
- B. Install enclosed controllers where indicated, in accordance with NECA "Standard of Installation."
- C. Install enclosed controllers plumb.
- D. Provide fuses for fusible switches.
- E. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- F. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder.

3.2 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.

- B. Perform inspections and tests listed in NETA ATS, Section 7.16.2.

END OF SECTION

26 06 22 – DISTRIBUTION PANEL-BOARDS

PART 1 GENERAL

1.1 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70 and 2013 **CAL Green Code**
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Furnished by Owner.

2.2 SWITCHBOARD

- A. Description: NEMA PB 2 switchboard with electrical ratings and configurations as indicated and specified.
- B. Ratings:
 - 1. **Voltage: 208Y/120 volts.**
 - 2. **Configuration: Three phase, four wire, grounded.**
 - 3. **Main Bus: As required for the facility.**
 - 4. **Integrated Equipment Rating: 200,000 rms amperes symmetrical.**
- C. Main Section Devices: Individually mounted.
- D. Distribution Section Main Device: Individually mounted and compartmented.
- E. Auxiliary Section Devices: Panel mounted.
- F. Bus Material: Aluminum with tin plating, standard size.
- G. Bus Connections: Bolted, accessible from front for maintenance.

- H. Fully insulate load side bus bars. Do not reduce spacing of insulated bus. Use factory applied tape wrapping or spray applied 105 degrees C minimum insulating material.
- I. Ground Bus: Extend length of switchboard.
- J. Molded Case Circuit Breakers: NEMA AB 1, integral thermal and instantaneous magnetic trip in each pole.
 - 1. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.**
 - 2. Include shunt trip, under-voltage release, and auxiliary contact where required.**
- K. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.
- L. Pull Section: Arrange as required for the facility.
- M. Enclosure: Type 1 - General Purpose NEMA 3R.
 - 1. Align sections at front and rear.**
 - 2. Switchboard Height: 90 inches, excluding floor sills, lifting members and pull boxes.**
 - 3. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.**
 - 4. Mimic Bus: Show bussing, connections and devices in single line form on the front panels of the switchboard using black color lines on a white plastoid laminated panel, fastened flat against the panel face with rivets.**

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install switchboard in locations shown on Drawings, according to NEMA PB 2.1.

- B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

3.2 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.1.

END OF SECTION

26 18 39 – Motors

PART 1 GENERAL

1.1 WARRANTY

- A. Section 01 78 00 - Closeout Submittals.
- B. Provide 3 year manufacturer warranty for motors larger than 1 horsepower.

PART 2 PRODUCTS

2.1 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Motors Less Than 250 Watts, for Intermittent Service: Equipment manufacturer's standard and need not conform to these specifications.
- B. Single Phase Motors: PSC where available.
- C. Electrical Service:
 - 1. **Motors smaller than 1/2 HP: 120 volts, single phase, 60 Hz.**
 - 2. **Motors 1/2 Horsepower and larger: 208 volts or 460 volts, three phase, 60 Hz.**
- D. Open drip-proof type except where specifically noted otherwise.
- E. Design for continuous operation in 40 degrees C environment.
- F. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
- G. Explosion-Proof Motors: UL approved for hazard classification.
- H. Visible Nameplate: Indicating manufacturer's name and model number, motor horsepower, RPM, frame size, voltage, phase, cycles, full load amps, insulation system class, service factor, maximum ambient temperature, temperature rise at rated horsepower, minimum efficiency.

I. Wiring Terminations:

1. **Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.**
2. **For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.**

2.2 SINGLE PHASE POWER - SPLIT PHASE MOTORS

- A. Starting Torque: Less than 150 percent of full load torque.
- B. Starting Current: Up to 7 times full load current.
- C. Breakdown Torque: Approximately 200 percent of full load torque.
- D. Drip-proof Enclosure: Class A (110 degrees F temperature rise) insulation, NEMA Service Factory, prelubricated sleeve or ball bearings.
- E. Enclosed Motors: Class A (110 degrees F temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.3 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

- A. Starting Torque: Exceeding one fourth of full load torque.
- B. Starting Current: Up to 6 times full load current.
- C. Multiple Speed: Through tapped windings.
- D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (110 degrees F temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.4 SINGLE PHASE POWER - CAPACITOR START MOTORS

- A. Starting Torque: Three times full load torque.
- B. Starting Current: Less than 5 times full load current.

- C. Pull-up Torque: Up to 350 percent of full load torque.
- D. Breakdown Torque: Approximately 250 percent of full load torque.
- E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with 2 capacitors in parallel with run capacitor remaining in circuit at operating speeds.
- F. Drip-proof Enclosure: Class A (100 degrees F temperature rise) insulation, NEMA Service Factor, prelubricated ball bearings.
- G. Enclosed Motors: Class A (100 degrees F temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.5 THREE PHASE POWER - SQUIRREL-CAGE MOTORS

- A. Starting Torque: Between 1 and 1-1/2 times full load torque.
- B. Starting Current: Six times full load current.
- C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
- D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B [energy efficient] motors.
- E. Insulation System: NEMA Class B or better.
- F. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
- G. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.
- H. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum AFBMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

- I. Sound Power Levels: To NEMA MG 1.
- J. Part Winding Start Above 254T Frame Size: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.
- K. Nominal Efficiency: To NEMA MG 1, energy efficient for frame sizes 215T motor sizes 10 and larger.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Section 01 45 00 - Quality Control: Manufacturer's instructions.
- B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

26 41 00 – FACILITY LIGHTNING PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing and installation of a complete UL master labeled lightning protection system.

1.2 RELATED WORK

- A. Section 07 60 00, FLASHING AND SHEET METAL: Penetrations through the roof.
- B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground faults. Avoid bonding buried steel to buried copper conductors and ground rods which sets up a galvanic cell that will corrode the steel.
- D. Section 26 42 00 CATHODIC PROTECTION: Requirements for protection of buried ferrous equipment from galvanic corrosion.
- E. Section 26 43 13, SURGE PROTECTIVE DEVICES: Surge protective device installed at the electrical service entrance.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS, (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1. Shop Drawings:
 - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
 - b. Show locations of air terminals, connections to required metal surfaces, down conductors, and grounding means.
 - c. Show the mounting hardware and materials used to attach air terminals and conductors to the structure.

2. Certifications: Two weeks prior to final inspection, submit the following.

- a. Certification by the manufacturer that the lightning protection system conforms to the requirements of the drawings and specifications.
- b. Certification by the Contractor that the lightning protection system has been properly installed and inspected.
- c. Certification that the lightning protection system has been inspected by a UL representative and has been approved by UL without variation.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. National Fire Protection Association (NFPA):

70-11.....National Electrical Code (NEC)

780-11.....Standard for the Installation of Lightning Protection Systems

C. Underwriters Laboratories, Inc. (UL):

96-05.....Lightning Protection Components

96A-07.....Installation Requirements for Lightning Protection Systems

467-07.....Standard for Grounding and Bonding Equipment

SPEC WRITER NOTE: Delete between // ---- // if not applicable to project. Also delete any other item or paragraph not applicable to the section and renumber the paragraphs.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Lightning protection components shall conform to NFPA 780 and UL 96, for use on //Class I// //Class II//structures. Aluminum materials are not allowed.
 - 1. //Class I// //Class II//conductors: Copper.
 - 2. Class I air terminals: Solid copper, //460 mm (18 inches) // long, not less than 9.5 mm (3/8 inch) diameter, with sharp //bare copper// //nickel-plated// points.

//3. Class II air terminals: Solid copper, //460 mm (18 inches)// long, not less than 12.7 mm (1/2 inch) diameter, with sharp //bare copper// //nickel-plated// points.//

4. Ground rods: //Copper-clad steel// //Steel// //Stainless steel//, 0.75 in (19 mm) diameter by 3 m (10 feet) long.

The Electrical Contractor will determine type and number of ground rods to be used, based on local conditions, earth resistivity data, and on the size and type of the electrical installation. Copper clad steel rods will typically be specified for normal conditions. Galvanized coated steel or stainless steel rods will be typically used where low soil resistivities are encountered and galvanic corrosion may occur between adjacent underground metallic masses and the copper-clad rods. Stainless steel rods have a longer life than the zinc coated steel, but use must be justified based on the higher cost. In high resistivity soils, 3.048 m (10 foot) sectional rods may be used to obtain the required resistance to ground; however where rock is encountered, additional rods, a counterpoise, or ground grid may be necessary. Coordinate and standardize rod selection for individual facilities with other specification sections.

5. Ground plates: Solid copper, not less than 20 gauge.
6. Bonding plates: Bronze, 50 square cm (8 square inches).
7. Through roof connectors: Solid copper riser bar, length and type as required to accommodate roof structure and flashing requirements.
8. Down conductor guards: Stiff copper or brass.
9. Anchors and fasteners: Bronze bolt and clamp type shall be used for all applications except for membrane roof. Adhesive type are allowed only for attachment to membrane roof materials, using adhesive that is compatible with the membrane material.
10. Connectors: Bronze clamp-type connectors shall be used for roof conductor splices, and the connection of the roof conductor to air terminals and bonding plates. Crimp-type connectors are not allowed.
11. Exothermic welds: Exothermic welds shall be used for splicing the roof conductor to the down conductors, splices of the down

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conductors, and for connection of the down conductors to ground
rods, ground plates, and the ground ring.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be coordinated with the roofing manufacturer and installer.
- B. Install the conductors as inconspicuously as practical.
- C. Install the down conductors within the concealed cavity of exterior walls where practical. Run the down conductors to the exterior at elevations below the finished grade.
- D. Where down conductors are subject to damage or are accessible near grade, protect with down conductor guards to 2.4 m (8 feet) above grade. Bond down conductor guards to down conductor at both ends.
- E. Make connections of dissimilar metal with bimetallic type fittings to prevent electrolytic action.
- F. Install ground rods and ground plates not less than 600 mm (2 feet) deep and a distance not less than 900 mm (3 feet) nor more than 2.5 m (8 feet) from the nearest point of the structure. Exothermically weld the down conductors to ground rods and ground plates in the presence of the //Resident Engineer// //COTR//.
- G. Bond down conductors to metal main water piping where applicable.
- H. Bond down conductors to building structural steel.

The Electrical Contractor shall determine which equipment is required to be bonded, and which equipment requires an air terminal(s), depending on metal thickness.
- I. Connect roof conductors to all metallic projections and equipment above the roof as indicated on the drawings.
- J. Connect exterior metal surfaces, located within 900 mm (3 feet) of the conductors, to the conductors to prevent flashovers.
- K. Maintain horizontal or downward coursing of main conductor and insure that all bends have at least an 200 mm (8 inches) radius and do not exceed 90 degrees.
- L. Conductors shall be rigidly fastened every 900 mm (3 feet) along the roof and down to the building to ground.

- M. Air terminals shall be secured against overturning either by attachment to the object to be protected or by means of a substantial tripod or other braces permanently and rigidly attached to the building or structure.
- N. Install air terminal bases, cable holders and other roof-system supporting means without piercing membrane or metal roofs.
- O. Use through-roof connectors for penetration of the roof system. Flashing shall be provided by roofing contractor in accordance with Section 07 60 00, FLASHING AND SHEET METAL.
- P. Down conductors coursed on or in reinforced concrete columns or on structural steel columns shall be connected to the reinforcing steel or the structural steel member at its upper and lower extremities. In the case of long vertical members an additional connection shall be made at intervals not exceeding 30 M (100 feet).
- Q. A counterpoise or ground ring, where shown, shall be of No. 1/0 copper cable having suitable resistance to corrosion and shall be laid around the perimeter of the structure in a trench not less than 600 mm (2 feet) deep at a distance not less than 900 mm (3 feet) nor more than 2.5 M (8 feet) from the nearest point of the structure.
- R. On construction utilizing post tensioning systems to secure precast concrete sections, the post tension rods shall not be used as a path for lightning to ground.
- S. Where shown, use the structural steel framework or reinforcing steel as the down conductor.
1. Weld or bond the non-electrically-continuous sections together and make them electrically continuous.
 2. Verify the electrical continuity by measuring the ground resistances to earth at the ground level, at the top of the building or stack,

- and at intermediate points with a sensitive ohmmeter. Compare the resistance readings.
3. Connect the air terminals together with an exterior conductor connected to the structural steel framework at not more than 18 m (60 foot) intervals.
 4. Install ground connections to earth at not more than 18 m (60 foot) intervals around the perimeter of the building.
 5. Weld or braze bonding plates to cleaned sections of the steel and connect the conductors to the plates.
 6. Do not pierce the structural steel in any manner. Connections to the structural steel shall conform to UL 96A.

3.2 ACCEPTANCE CHECKS AND TESTS

- A. Test the ground resistance to earth by standard methods, and conform to the ground resistance requirements specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- B. A UL representative shall inspect the lightning protection system. Obtain and install a UL numbered master label for each of the lightning protection systems at the location directed by the UL representative.

---END---

26 51 13 – INTERIOR LUMINAIRES

PART 1 GENERAL

1.1 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Conform to requirements of NFPA 101.
- C. Products: Listed and classified by Underwriters Laboratories, Inc.
- D. 2013 **CAL Green** (lighting controls and energy management)

PART 2 PRODUCTS

2.1 LUMINAIRES

- A. Refer to Lighting Fixture Schedule in Drawings.
- B. Comply with all CalGreen and California Energy Title 24 provisions
- C. Commissioner shall verify and certify installation where applicable. Important considerations to be addressed whether specifically detailed on drawings or not are:
 - 1. **Occupancy sensor, time clock or lighting control panel is required even for temporary lighting in a shell permit building for automatic shut-off control.**
 - 2. **Accessible, independent switching or a control device is included for all areas enclosed by ceiling height partitions.**
 - 3. **General lighting is controlled separately from all other lighting systems.**
 - 4. **General lighting of enclosed spaces exceeding 100 square feet with a lighting load exceeding 0.5 W/sf, must have multi-level lighting controls from at least one of the following methods: manual dimming, lumen maintenance, tuning, automatic daylighting controls, demand responsive lighting controls.**
 - 5. **Provide shut-off controls controlled with occupant sensing devices, automatic time-switch control, signal**

from another building system or other controls for all indoor lighting systems.

- 6. Daylight areas required for conditioned or unconditioned spaces greater than 5,000 sq. ft. of roof area and with a ceiling height greater than 15 feet (Major B) must meet requirements of T24 section 140.3(c): Skylights required to reach 75% daylight zones.**
- 7. All skylit daylit zones, primary sidelit zones and secondary sidelit daylit zones are shown on plans. Controls of skylit and sidelit zones are independent and provide multi-level lighting. Reduce general lighting power by a minimum of 65% when daylit illuminance is 150% of design illuminance.**
- 8. Verify and provide schematic drawing locations of all photo sensors, height and position criteria. Photo sensors are not to be installed in direct sunlight nor in direct light of lighting fixtures.**
- 9. The amount of light to be gathered by the photo sensor in relation to its location for the lighted surface must be verified for compliance. For example: if 5 FC on the horizontal floor is the maintained lighting level and the sensor is mounted 15 feet off the floor, the sensor must be capable of detecting 5 FC from floor at that distance.**
- 10. Sensor and dimming settings shall be set up and calibrated after furniture and final finishes and all lighting equipment are installed and operational.**
- 11. Provide a complete step by step sequence of operation defining the lighting levels (maximum and minimum), zones, interaction with occupants, interaction with occupancy and time-clock controls, and interactions with lighting on-off or dimming switches.**
- 12. Daylight dimming controls shall be properly integrated with emergency fixtures, using separate ballasts for dimming and emergency backup.**
- 13. Daylight zones that penetrate more than one row of fixtures from the storefront glass may necessitate moving the assembly closer to the windows receiving a lower light command to create a more even lighting and save energy (field verify).**

- 14. Submit product cut sheets and information for ballasts that are able to turn down as low as required for the daylight dimming system.**
- 15. To save energy, dimming devices and systems require that the illumination during night time shall be adjusted to be 20% or more lower than the daytime target, since the apparent illumination at night will appear higher.**

2.2 OCCUPANT SENSOR LIGHTING CONTROL SYSTEMS

A. General: An active sensor shall be utilize to control the “ON-OFF” actuation of fluorescent or incandescent lighting loads. It shall provide control of an isolated set of contracts on exposure to a perceived change in environmental conditions indicating the presence or absence of one or more persons. It shall maintain the contacts closed in the presence of continued changes (due to human presence) at similar intensity and rate. Device(s) shall open the contracts as a nominal time after the changes cease.

B. Active Sensor System: Sensor(s) shall react to reflective changes to generated ultrasonic radiation (crystal controlled, 24 to 42kHz), indicating the activity of one or more persons in the area covered.

1. Range of detection: On ceilings below 3600 mm (twelve feet) in height, a single direction sensor shall cover approximately a 9 x 9 m (30 feet x 30 feet) area; a two directional unit a 18 x 9 m (60 feet x 30 feet) area; and a two-way corridor unit a total distance of 27 m (90 feet). The sensors shall be equipped with a concealed by accessible sensitivity control to tune the unit to specific room conditions. Refer to 2013 CAL Green mandatory compliance measures.

2. Sensor placement: Locate the sensor(s) in accordance with the manufacturer’s recommendations to maximize energy savings by avoiding nuisance activation due to predictable non-human motion activities. Give particular attention to work station or major areas of activity and the coverage of room entrance doors.

C. Timing/Function: Shall not be user adjustable. Lighting shall remain on with one or more persons within the covered area. The system shall be factory set to maintain lights on for a

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minimum of 8 minutes and not longer than 12 minutes
after the area of coverage is vacated. For testing
purposes, there shall be a means to change the pre-set time delay of 30
seconds or less.

- D. Control Unit: The system shall have a switching relay(s) capable of switching the fluorescent or incandescent loads as required. Contacts shall be rated at a minimum of 15 Amps at voltages to 277, with expected cycles of operation in excess of 100K. Power derived from a current limiting 24 volt transformer shall power the system and the unit must be packaged to installation on a standard (4 inch x 4 inch) NEMA box enclosure.
- E. Field Wiring: The wiring between the control unit and sensor(s) shall be 3 conductor #22 gauge Poly Vinyl Chloride (PVC) jacketed.

2.3 2.3 EXIT LIGHT FIXTURES

- A. Exit light fixtures shall meet applicable requirements of UL 924.
- B. Housing and Canopy:
 - 1. Shall be made of cast or extruded aluminum, or rolled steel.
 - 2. Optional steel housing shall be a minimum 20 gauge thick or equivalent strength aluminum.
 - 3. Steel housing shall be baked enamel over corrosion resistant, matte black or ivory white primer.
- B. Door frame shall be cast or extruded aluminum, and hinged with latch.
- C. Finish shall be satin or fine-grain brushed aluminum.
- D. There shall be no radioactive material used in these fixtures.
- E. Directional Arrows: Fixtures shall be furnished with directional arrows where shown on drawings. Directional arrows shall be the “chevron-type” of similar size and width as the letters and meet the requirements of NFPA 101.
- F. Voltages: Fixtures shall be wired for 120-volt operation.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- B. Support luminaires larger than 2 x 4 foot size independent of ceiling framing.
- C. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- D. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- E. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.
- F. Install recessed luminaires to permit removal from below.
- G. Install recessed luminaires using accessories and fire-stopping materials to meet regulatory requirements for fire rating.
- H. Install clips to secure recessed grid-supported luminaires in place.
- I. Install wall mounted luminaires and exit signs at height as indicated on Drawings.
- J. Install accessories furnished with each luminaire.
- K. Connect luminaires, emergency lighting units and exit signs to branch circuit outlets using flexible conduit.
- L. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- M. Bond products and metal accessories to branch circuit equipment grounding conductor.

- N. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.
- O. Installation shall be in accordance with the NEC, manufacturer’s instructions and as shown on the drawings or specified.
- P. Align, mount and level the lighting fixtures uniformly.
- Q. Avoid interference with the provide clearance for equipment. Where the indicated locations for the lighting fixtures conflict with the locations for equipment, change the locations for the lighting fixtures by the minimum distances necessary as approved by the Architect.
- R. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings or as specified by the Architect.
- S. Lighting Fixture Supports:
 - 1. Shall provide support for all of the fixtures. Supports may be anchored to channels for the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
 - 2. Shall maintain the fixture positions after cleaning and re-lamping.
 - 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
 - 4. Hardware for recessed fluorescent fixtures:
 - a. Where the suspended ceiling system is supported at the four corners of the fixture opening, hardware devices shall clamp the fixture to the ceiling system structural members, or plaster frame at not less than four points in such a manner as to resist spreading of the support members and safely lock the fixture into the ceiling system.
 - b. Where the suspended ceiling system is not supported as the four corners of the fixture opening, hardware devices shall independently support the fixture from the building structural at four points.

5. Hardware for surface mounting fluorescent fixtures to suspended ceilings:

a. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 6 mm (1/4 inch) secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lick into place and require simple tools for removal.

b. In addition to being secured to any required outlet box, fixtures shall be bolted to a plaster ceiling at four points spaced near the corners of each fixture. Pre-positioned 6 mm (1/4 inch) studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 6 mm (1/4 inch) toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

4. Surface mounted lighting fixtures:

a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 6 mm (1/4 – 20) bolt, secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners an cross runners with special non-friction clip devices designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12 gauge safety hangers. Studs or bolts securing fixtures weighing in excess of 25 kg (56 pounds) shall be supported directly from the building structure.

b. Where ceiling cross runners are installed for support of lighting fixtures they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.

- T. Furnish and install the specified lamps for all lighting fixtures installed and all existing lighting fixtures reinstalled under this project.

- U. Coordinate between the electrical and ceiling trades to ascertain approved lighting fixtures are furnished in the proper sizes and proper devices (hanger, clips, trim frames, flanges), to match the ceiling system being installed.

- V. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 16450, GROUNDING..

- W. At completion of project, re-lamp all fixtures which have failed/burned-out lamps. Clean all lenses, diffusers and louvers which have accumulated dust/dirt during construction.

3.2 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

- A. Refer to Section 01 75 00 for adjusting installed work.
- B. Aim and adjust luminaires as directed.

END OF SECTION

26 56 00 – EXTERIOR LUMINAIRES

PART 1 GENERAL

1.1 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.
- C. 2013 **CAL Green** (controls and environmental measures): Verify and address the following crucial compliance topics:
 - 1. **All outdoor lighting to be controlled by photo-control or outdoor astronomical time-switch control.**
 - 2. **Outdoor lighting (parking lot and building facades) installed where the bottom of the luminaire is mounted 24 feet or less above adjacent grade must be controlled by motion sensors or other controls that are capable of reducing the lighting power of each luminaire by 40 to 80 percent in response to the area vacated.**

PART 2 PRODUCTS

2.1 LUMINAIRES AND ACCESSORIES

- A. General: certified for use in California
- B. Wiring: Provide electrical wiring within fixtures which is suitable for connection to branch circuit wiring per NEC Type AF for 120 volt, minimum No. 18 AWG.

2.2 POLES

- A. General: Refer to Electrical Site Plan for schedule

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install poles plumb. Provide double nuts to adjust plumb. Grout around each base.
- B. Install lamps in each luminaire.
- C. Bond luminaires, metal accessories and metal poles to branch circuit equipment grounding conductor. Provide supplementary grounding electrode at each pole.
- D. All perimeter lighting shall be automatically controlled.

3.2 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.
- B. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.3 ADJUSTING

- A. Aim and adjust luminaires to provide illumination levels and distribution as directed.

END OF SECTION

28 05 13 – FIRE DETECTION & ALARM SYSTEM

1 PART ONE – GENERAL

1.1 DESCRIPTION

- A. This section of the specification includes the furnishing, installation, and connection of the microprocessor-controlled fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panel, auxiliary control devices, annunciators, power suppliers, and wiring as shown on the drawings and specified herein.
- B. The fire alarm system shall comply with requirements of NFPA Standard No. 72 for protected premises signaling systems except as modified and supplemented by this specification. The system field wiring shall be supervised either electrically or by software – directed polling of field devices.
- C. The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.
- D. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).
- E. Underwriters Laboratories Inc. (UL) – USA:
1. No. 50 – Cabinets and Boxes.
 2. No 268 – Smoke Detectors for Fire Protective Signaling Systems
 3. No. 864 – Control Units for Fire Protective Signaling Systems.
 4. No. 268A – Smoke Detectors for Duct Applications.
 5. No. 521 – Heat Detectors for Fire Protective Signaling Systems.
 6. No. 228 – Door Closer/ HOLDERS for Fire Protective Signaling Systems.
 7. No. 464 – Audible Signaling Appliances.
 8. No. 1971 – Visual Signaling Appliances.
 9. No. 38 – Manually Actuated Signaling Boxes.

10. No. 346 – Waterflow Indicators for Fire Protective Signaling Systems.

11. No. 1481 – Power supplies for Fire Protective Signaling Systems.

F. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to supervision the installation of all devices. The system supplier shall perform the final check-out and Fire Department Inspection to ensure the system's integrity.

1.2 SCOPE

A. A new microprocessor controlled fire detection and alarm system shall be installed in accordance with the specifications and drawings.

B. Basic Performance:

1. Initiating Device Circuits (IDC) shall be wired Class B (NFPA Style B).

2. Notification Appliance Circuits (NAC) shall be wired Class B (NFPA Style Y).

1.3 SUBMITTALS

A. General

All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality. Equivalent equipment (compatible UL Listed) from other manufactures may be substituted for the specified equipment.

B. Shop Drawings:

Include manufacturer's name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, and point-to-point diagrams.

C. Manuals:

Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer's name(s)

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technical data sheets (with model numbers to

D. Certifications:

Together with the shop drawings submittal, submit a certification from the major equipment manufacturer indicating that the processed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

1.4 GUARANTY

- A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance.

1.5 POST CONTRACT MAINTENANCE

A. Complete maintenance and repair service for the fire alarm system shall be available from a factory trained authorized representative of the major equipment manufacturer for a period of five (5) years after guaranty expiration.

B. As part of the submittal work, include a quote for a maintenance contract to provide all maintenance tests and repair as required after the warranty period. Include also a quote of hourly rates, response time and technician travel costs. Submittals which do not include a complete statement of maintenance costs will not be accepted.

1.6 PERFORMANCE CRITERIA / APPLICABLE PUBLICATIONS

- A. The publications and/or standards listed below form a part of this specification. The publications are referenced in text by the basic designation only.
 - 1. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and shall be installed in compliance with the UL listing.
 - 2. Local and State Building Codes
 - 3. All requirements of the Authority Having Jurisdiction (AHJ).

1.7 PERFORMANCE CRITERIA / APPROVALS

- A. Each system must have proper listing and/or approval from the nationally recognized agency responsible for the particular area.
 - 1. UL Underwriters Laboratories, Inc.
 - 2. MEA Material Equipment Acceptance (NYC).
 - 3. CSFM California State Fire Marshal.

2 PART TWO – PRODUCTS

2.1 BATTERIES

- A. Shall be sealed, Gel-Cell acid type.
- B. Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.
- C. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.
- D. If necessary to meet standby requirements, external battery and charger systems may be used.

2.2 SYSTEM COMPONENTS

- A. Enclosure:
 - 1. The control panel shall be housed cabinet suitable for flush mounting.
- B. Power Supply:
 - 1. The Main Power Supply for the Fire Alarm Control Panel shall provide all control panel and peripheral device power needs, as well as 3.0 amperes of 24 VDC power for each NAC. 2. The power supply shall provide an integral battery charger for use with batteries up to 17 AH.
- C. Specific System Operations

1. Walk Test Operation:

- a. Walk Test mode shall test Initiating Device Circuits and Notification Device Circuits from the field returning to the panel to without reset the system.
- b. Upon activation of an IDC, all outputs normally activated by the tested zone shall activate for four seconds. Subsequent activation of devices on the same zone will activate outposts for one second.
- c. Inducing a trouble into the initiating circuit shall activate the controlled outputs and remain activated until the troubles cleared.

2. Alarm Verification Operation

- a. When an alarm condition is detected on an Initiating Device Circuit which has been programmed for Alarm Verification shall cause the panel to remove power to that IDC to reset 2 wire detectors. After a short reset and retard time if that circuit returns within the confirmation time it will cause a verified alarm.

3. Waterflow Operation

- a. All Initiating Device Circuits shall be programmable to provide Water flow detection. If an alarm occurs on a Water flow zone, all Notification Appliance Circuits which are programmed to activate for that zone will not be affected by the silence switch.
- b. A programmable retard timer shall be available for water flow circuits. This timer shall allow retards for 1-89 seconds.

4. Supervisory Operation

- a. An alarm on a Supervisory circuit shall activate all programmed (mapped) outputs, activate a common

is in alarm.

Supervisory LED, and activate the zone which

- 5. Signal Silence Operation
 - a. All Notification Appliance Circuits of the system shall be capable of being programmed to deactivate of the Signal Silence switch.
- 6. Pre-signal Operation
 - a. The control panel shall have the capability of operation in a pre-signal mode.
- D. Programmable Electronic Sounders:
 - 1. Electronic sounders shall operate on 24 VDC nominal.
 - 2. Electronic sounders shall be field programmable without in the use of special tools, to provide slow whoop, continuous, or tones with an output sound level of at least 90 DBA measured at 10 feet from the device.
 - 3. Shall be flush or surface mounted as shown on plans.
 - 4. Sounders shall be programmed for temporal 3 sound.
 - 5. All sounders and strobes are to be synchronized.
 - 6. Sounder/Strobes are to be the Notifier HS series devices.
 - 7. Sync Module shall be the Notifier AVS-44 Module.
- E. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the followings criteria:
 - 1. The maximum pulse duration shall be 2/10 of one second.
 - 2. Strobe intensity shall meet the requirements of UL 1971.
 - 3. The flash rate shall meet the requirements of UL 1971.
 - 4. All sounders and strobes are to be synchronized.
 - 5. Strobes are to be the Notifier ST series device.

F. Manual Fire Alarm Stations:

- 1. Manual fire alarm stations shall be non-code, non-breakglass type, equipped with key lock so that they may be tested without operating the handle.
- 2. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset.
- 3. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet (30.5 m) front or side.
- 4. Manual stations shall appear on the manual station in letters 1/2 inch (12.7 mm) in size or larger.

G. Duct Smoke Detectors:

- 1. Duct smoke detectors shall be a 24 VDC type with visual alarm and power indicators, and a reset switch. Each detector shall be installed upon the composite supply/return air duct(s), with properly sized air sampling tubes.
- 2. Provide remote indicators for all duct detectors above suspended ceilings. The remote indicator shall be located on the ceiling below the detectors. Remote indicated shall be located so as to not interfere with access to the detector for service and inspection.

H. Water flow / Tamper Switches:

- 1. Water flow and Tamper switches shall be provided by the contractor and connected by this contractor.

3 PART THREE – EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

D. Manual pull stations shall be suitable for surface mounting on matching backbox, or semi-flush mounting on standard single gang box, and shall be installed not less than 42 inches or more than 48 inches above the finished floor.

3.2 TEST

Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.

- A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- B. Close each sprinkler system control valve and verify proper supervisory alarm at the FACP.
- C. Verify activation of all flow switches.
- D. Open initiating device circuits and verify that the trouble signal actuates.
- E. Open and short Notification appliance circuits and verify that the trouble signal actuates.
- F. Ground device circuits and verify response of trouble signals.
- G. Check proper operation of all alarm notification devices.
- H. Check installation, supervision, and operation of smoke detectors.

- I. Verify that each initiating device alarm signal is properly received and processed by the fire alarm control panel (Walk Test).
- J. Conduct tests to verify trouble indications for common mode failures, such as alternating current power failure.

3.3 FINAL INSPECTION

At the final inspection a representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

3.4 INSTRUCTION

Provide instruction as required to the building personnel and fire and safety personnel. "Hands-on" demonstrations of the operation of the system shall be provided.

END OF SECTION

28 10 10– SECURITY ACCESS & SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Security Surveillance equipment and components are supplied and installed by owner. GC shall be responsible for supports, junction boxes, conduits, pull wires and other components and accessories as required for a complete installation.

1.2 SUMMARY

- A. This Section includes security surveillance equipment including, cameras, intimidation system, video monitor, smoked glass panels and domes, and miscellaneous components.

1.3 RELATED SECTIONS:

- A. Overhead Rolling Doors - Section 08 33 10
- B. Door Hardware - Section 08 71 00
- C. Electrical - Section 16 05 00

1.4 SUBMITTALS

- A. N/A

PART 2 - PRODUCTS

A.1 MANUFACTURERS

- A. Manufacturers: All products and equipment by owner.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all security surveillance complete with necessary hardware, in

□City of Rancho Mirage City Project No. CP15-315 Rancho Mirage Observatory□
accordance with approved shop drawings, manufacturer's instructions, and as specified.

- B. Exterior surveillance cameras are to be installed to provide complete coverage of building exterior, including sidewalks, parking area, driveways, and rear exit doors.
- C. After completion of installation, test and adjust security equipment to satisfaction of the project owner

31 10 00 – SITE CLEARING

PART 1 GENERAL

1.1 REGULATORY REQUIREMENTS

- A. Conform to applicable state and locally adopted building codes for disposal of debris.
- B. Conform with applicable portions of O.S.H.A.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Herbicide: Round-up by Monsanto.

PART 3 EXECUTION

3.1 PREPARATION

- A. Verify that existing plant life and features designated to remain are tagged or identified.
- B. Locate and identify utilities intended to remain.
- C. Call before dig: Underground Service Alert (1-800) 227-2600

3.2 PROTECTION

- A. Protect plant growth and features remaining as final landscaping. Flag as required to properly identify items to remain.
- B. Protect bench marks and existing work from damage or displacement.
- C. Protect remaining utilities from damage.

3.3 CLEARING

- A. Dilute and apply herbicide in accordance with manufacturer's recommendations.

- B. Clear areas required for access to site and execution of Work.
- C. Remove trees and shrubs within marked areas. Grub out stumps, roots, and surface rock. Use only hand methods for grubbing inside drip line of trees indicated to remain.
- D. Clear undergrowth and deadwood, without disturbing subsoil.
- E. Burning debris on site is not permitted.
- F. Remove debris, rock, and extracted plant life from site.

3.4 CUTTING CURBS AND GUTTERS

- A. Make new openings in curbs and gutters neat, as close as possible to profiles indicated and only to extent necessary for new work.
- B. At concrete, paving, and other materials where edges of cuts remain exposed in the completed work, make cuts using power-sawing equipment. Do not overcut at corners of cut openings.

3.5 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, re-landscaped, or re-graded.
- B. Stockpile in area designated on site to depth not exceeding 8 feet. Protect from erosion. Remove from site excess topsoil not being reused.

3.6 REMOVAL

- A. Remove debris from site. Leave site in clean condition ready for earthwork.

END OF SECTION

31 31 16 – TERMITE CONTROL

PART 1 GENERAL

1.1 REGULATORY REQUIREMENTS

- A. Conform to applicable requirements of authorities having jurisdiction for application licensing and authority to use toxicant chemicals.

1.2 WARRANTY

- A. Provide 5 year warranty for material and installation.
- B. Warranty: Cover against invasion or propagation of subterranean termites, damage to building or building contents caused by termites, and repairs to building or building contents so caused.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Toxicant Chemical: Water based emulsion, uniform composition, synthetic dye to permit visual identification of treated soil, of the following chemical element and concentrations
 - 1. Chloropyrifos: Dursban TC as manufactured by Dow Chemical, 1% solution.**
 - 2. Permethrin: "Dragnet" by FMC or Torpedo" by ICI Americas, 0.5 percent in water emulsion.**
- B. Substitutions: Submit in accordance with Section 01 32 19.

2.2 MIX DILUTION

- A. Dilute toxicant chemical as recommended by manufacturer.

PART 3 EXECUTION

3.1 INSPECTION/PREPARATION

- A. Verify the soil surfaces are unfrozen, sufficiently dry to absorb toxicant, ready to receive treatment.

3.2 APPLICATION

- A. Apply toxicant no more than 12 hours prior to installation of vapor barrier under slab-on-grade or finish grading outside foundation walls.
- B. Apply toxicant in accordance with manufacturer's instructions.
- C. Apply extra treatment to structure penetrations, pipe, ducts, expansion joints and other soil penetrations.
- D. Apply as a coarse spray to ensure uniform distribution.
- E. Coordinate soil treatment at foundation perimeter with finish grading and landscaping work to avoid disturbance of treated soil. Retreat disturbed treated soil.
- F. Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations. To insure penetration, do not apply soil treatment to excessively wet soils or during inclement weather.
- G. Post signs in the areas of application, warning workers that soil poisoning has been applied. Remove signs when areas are covered by other construction.

END OF SECTION

31 66 10 – SPREAD & CONTINUOUS FOOTINGS

PART 1 GENERAL

1.1 QUALITY ASSURANCE

A. Installation Tolerances:

- 1. Maximum lateral variation off of centerlines: 2 inches.**
- 2. Plan Dimensions: Plus 3 inches, minus 1/2 inch.**
- 3. Thickness: Not smaller than scheduled sizes.**
- 4. Top of Footing Elevation: Plus 0 inches, minus 3 inches.**

1.2 SCHEDULING/SEQUENCING

- A. Coordinate Work of this Section with work of other Sections as required to properly execute the Work and as necessary to maintain satisfactory progress of the work of other Sections.
- B. Schedule footing excavations such that reinforcing and concrete can be placed immediately after excavations are completed and inspected.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Formwork: Refer to Section 03 11 00.
- B. Reinforcement: Refer to Section 03 20 00.
- C. Concrete: Refer to Section 03 30 00.

PART 3 EXECUTION

3.1 EXCAVATION

- A. Spread and continuous footings: Extend to and penetrate bearing materials shown on Drawings.
- B. Exposed subgrade soils: Examined in the field by a geotechnical engineer of the testing laboratory to verify the strength and bearing capacity.
- C. Excavations and footings:
 - 1. Size and shape as shown on the Drawings.**
 - 2. Bottom of each excavation: Level, undisturbed, free of water, caving material or any other foreign substance.**

3.2 FABRICATION AND PLACING OF REINFORCING

- A. Steel reinforcing mats: Fabricated in rigid fashion to permit expeditious placement into excavation with minimum time delay.
- B. Accurately place reinforcement in excavations, maintaining specified coverage. Secure to prevent displacement during concreting.

3.3 FIELD QUALITY CONTROL

- A. Testing Laboratory services: In accordance with Section 01 45 29.
- B. Inspect each concrete wall and column footing excavation to determine that proper bearing stratum is obtained and utilized for bearing and that excavations are properly clean and dry before placing concrete.
- C. Furnish complete footing log showing location, elevation of top of bearing stratum, footing size and depth, condition of material, excavation properly clean and dry before placing concrete, reinforcement in compliance with Contract Documents and any and all observed irregularities, deficiencies or deviations from Contract Documents.

3.4 INSPECTION

- A. Schedule footing excavation such that the concrete can be placed immediately after inspection.

3.5 PLACING OF CONCRETE:

- A. Place concrete so as to prevent segregation. Do not allow concrete to free fall over 5'-0"; provide tremie, chutes or other means of conveyance when drop exceeds this amount.
- B. Place concrete as soon as practical after the excavation has been completed.

END OF SECTION

32 80 00 – PLANTING**PART 1 GENERAL****1.1 QUALITY ASSURANCE**

- A. Source Quality Control: Furnish certificates of inspection of landscape materials, to accompany shipments, as required by governmental authorities. Comply with applicable Federal, state, county and local regulations governing landscape materials.

1.2 JOB CONDITIONS

- A. Proceed with and complete the landscape work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of landscape work required.
- B. Cooperate with other contractors and trades working in and adjacent to the landscape work areas. Examine drawings which show the development of the entire site and become familiar with the scope of other work required.
- C. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Owner's Representative before planting.
- D. Scheduling: Plant or install materials only during normal planting seasons for each type of landscape work required. Correlate planting with specified maintenance periods to provide maintenance until occupancy by the Owner.
- E. Site Utilities
- Determine locations of underground utilities, especially site lighting, and perform work in a manner which will avoid possible damage. Do not permit heavy equipment such as trucks to damage utilities. Hand excavate, as required to minimize possibility of damage to underground utilities. Maintain grade stakes set by others until removal is mutually agreed upon by all parties concerned.**

2. Coordinate work with the irrigation, electrical, and other trades to prevent damage to underground piping or conduit and similar obstruction work located in landscape areas.

- F. Protections: Do not move any equipment over existing or newly placed concrete without approval of Owner's Representative. Provide necessary protections such as board-roading as required.
- G. Provide water, hoses, other watering equipment and labor necessary for the work.
- H. Do not install plant life when ambient temperatures may drop below 35 degrees F or above 100 degrees F.

1.3 MAINTENANCE

- A. Until final acceptance or in accordance with the Warranty Program, maintain plantings and trees by watering, cultivating, weeding, controlling pests and diseases, cleaning and replacing as necessary to keep landscape in a vigorous, healthy condition. Rake bed areas as required.
- B. In general, provide maintenance as follows:
 - 1. Watering: As necessary to promote growth. Water will be available on site. Provide necessary hoses and other watering equipment required to complete work.**
 - 2. Watering Trees: Keep tree balls moistened to depth of tree ball.**
 - 3. Weeding: Remove weeds and foreign grass over plant areas at least once a week. Herbicides may be used only when approved by Owner's Representative.**
 - 4. Mowing and Edging: Mow and edge newly planted lawns when growth reaches 2-1/2 inches. Maintain at this height.**
 - 5. Application of pesticides in accordance with manufacturer's instructions. Remedy damage from use of pesticides.**
 - 6. Trimming and pruning, including removal of clippings and dead or broken branches, and treatment of pruned areas and other wounds.**
 - 7. Disease control.**

- 8. Maintaining wrapping, guys, turnbuckles, and stakes. Adjust turnbuckles to keep guy wires tight. Repair or replace accessories when required.**

PART 2 PRODUCTS

2.1 PLANTS

A. General

- 1. Well-formed No. 1 grade or better nursery stock, in accordance with ANSI Z-60 and as noted hereafter, subject to Owner's Representative's approval.**
- 2. Listed Plant Heights: From top of root ball to nominal top of plant.**
- 3. Provide only healthy, vigorous stock, grown under climatic conditions similar to conditions in the locality of the project and free of disease, insects, eggs, larvae, and defects such as knots, sun-scald, injuries, abrasions, or disfigurement.**

B. Shrub Size: As shown or scheduled. Trees and shrubs of larger size may be used if acceptable to Owner's Representative, in which case, increase size of roots or balls proportionately.

C. Tree Size: Unless otherwise stated, caliper size will refer to trunk diameter as determined in accordance with ANSI Z-60.1.

D. Ornamental and Shade Trees

- 1. Healthy, vigorous, full-branched, well-shaped, with trunk diameter and height requirements as specified.**
- 2. Balls: Firm, neat, slightly tapered and well bur lapped. Trees with loose or broken balls at time of planting will be rejected.**
- 3. Trees will be individually approved by the Owner's Representative.**
- 4. Ball Diameter: Minimum 10 inches for each 1 inch caliper measured 6 to 12 inches above root ball.**
- 5. Containers: Heavy gage plastic and wooden boxes only.**

- 6. Provide trees with full rounded crowns, meeting height and spread standards after pruning. No flat sided trees or trees with open areas on any side will be acceptable, consistently superior in form and branching, and typical of the growth habit of their species unless otherwise specified.**
- E. Multi-trunk Trees: Measure multi-trunk tree caliper as follows. Add the caliper of the largest trunk to one-half the calipers of the remaining trunks.
- 1. Example: An 8 inch caliper, multi-trunk could be 3 trunks of 5 inch/4 inch/2 inch or 5 inch/3 inch/3 inch).**
- F. Shrubs, Groundcovers, Perennials and Annuals: Nursery grown, healthy, vigorous, and of normal habit of growth for the species.
- G. Turf Grass Sod
- 1. Green, actively growing, with strong fibrous root system, free of weeds, stones, and foreign grasses of type indicated in Plant Schedule or on Drawings. Sod which is dormant, heat or drought stressed will not be accepted.**
 - 2. Cut sod with a minimum of 3/4 inch of soil covering the roots.**
 - 3. Deliver to the site in 12 inch squares or 12 inch wide rolls or pallets.**
 - 4. Do not stack more than 24 hours between time of cutting and time of delivery.**
- H. Mulching Material: Southern Pine species wood cellulose fiber, chip form, free of growth of germination inhibiting ingredients.
- I. Wildflower Seed: Free from weeds and grasses. If a mix is specified, the species composition and relative amounts will be found in the plant schedule. Seed batch specifications shall be available for examination. Seeding rates refer to PLS.
- J. Plants:
- 1. Conform to sizes and quality notes in plant list and as indicated, with the exception of that larger plants than**

those specified may be used if approved by the Owner's Representative. Use of larger plants shall not increase the contract price.

- 2. Specified sizes are after pruning.**
- 3. Measure plants with their branches in normal position.**
- 4. Normal, well-developed branches and vigorous, fibrous root systems, conforming to specifications of the last edition of ANSI Z60.1, Standards for Nursery Stock published by the American Association of Nurserymen, Inc. (A.A.N.).**
- 5. Healthy, vigorous and free from defects, decay, girdling roots, sun-scald injuries, abrasions of the bark, plant diseases, and insect pests, their eggs and larvae.**
- 6. Hardy grown under climatic conditions similar to those in the locality of the project.**

- K. Upon becoming aware of any condition that will adversely affect the long-term survival of any plant, notify the Owner's Representative before installation of the plant(s).

2.2 SOIL PREPARATION MATERIALS

- A. Bedding Soil:

1. Acceptable Manufacturer: Living Earth Technologies.

- B. Commercial Fertilizer: Complete fertilizer with an organic base, uniform in composition, dry and free-flowing. Deliver fertilizer to site in original unopened containers, each bearing manufacturer's guaranteed statement of analysis.

1. Fertilizer: Contain 20 percent nitrogen, 10 percent phosphoric acid, 10 percent potash, unless otherwise specified or approved.

- C. Peat Moss: Commercial Canadian coarse grade sphagnum moss.

- D. Pine Bark: Decomposed pine bark having a pH between 6.0 and 7.0, sterilized, and containing no harmful active residues, that is, pesticides, disease organisms and foreign chemicals, screened to particle size of 1 inch or smaller.

- E. Refer to Drawings for specific soil preparation materials which may be proprietary in nature. If such materials are indicated, provide only these proprietary materials unless specific approval of substitutions has been granted in accordance with Section 01600.

2.3 TOPSOIL

- A. Fertile, agricultural soil typical for locality. Refer to Section 02300 for specific information.

2.4 TREE STAKING AND GUYING MATERIALS

- A. Hose: New 3/4 inch rubber hose.
- B. Hardware
 - 1. Wire: #10 gage, galvanized.**
- C. Stakes: Steel "T" posts, minimum 5 feet in height.
- D. Warning Flags: Plastic surveyor's ribbon, international orange, 1 inch wide and 24 inches long, minimum.
- E. Tree Wrap: Heavy crepe paper, impregnated with insect repellent chemicals.
- F. Install staking and guying as indicated on the Drawings.
- G. Turnbuckles: Cadmium plated steel with 3 inch minimum lengthwise adjustment.

2.5 MISCELLANEOUS PRODUCTS

- A. Steel Edging: 4 inches wide, 1/8 inch thick, painted dark green with rust-resistant paint and stake loops welded or formed onto backside.
 - 1. Acceptable Product: Steel Edging by Ryerson Company.**
- B. Spikes: Similar material as steel edging, 18 inches long.
- C. Erosion Fabric: Jute matting, 4 inch open weave.
- D. Root Wrapping Materials: Quality burlap.

- E. Tree Wound Dressing: Black asphaltic based antiseptic paint.
- F. Herbicides – Acceptable Products:
 - 1. Pre-Emergent: Traflan 5% Granules.**
 - 2. Post-Emergent: Roundup.**
- G. Tree, Shrub, and Plant Bed Mulch: Shredded decomposed pine bark, having a pH between 6.0 and 7.0, sterilized, and containing no harmful active residues, that is, pesticides, disease organisms and foreign chemicals, uniform in size with a medium particle size of 1-1/2 inch, free of sticks, stones, leaves and other debris.
- H. Ground Cover Mulches: Clean, dry hay or straw or wood fiber mulching tinted green.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine subgrade, verify elevations noted on the Drawings, observe the conditions under which work is to be performed, and notify Owner's Representative of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Contractor and Owner's Representative.
- B. Beginning of installation means acceptance of existing site.
- C. Verify location of underground irrigation lines and other utilities.

3.2 SOIL PREPARATION

- A. Trees
 - 1. General: Refer to the Drawings for tree locations.**
 - 2. Backfill Soil: Unless noted on drawings, backfill tree planting pits with native topsoil.**
 - a. Topsoil: Free from rocks, construction debris and other foreign materials. Do not use soil amendments.
- B. Shrubs and Ground Covers

- 1. General: Refer to the Drawings for shrub area locations.**
 - a. Shrub areas with ground cover: Rough grade in bed areas will be left 4 inches low prior to work of this Section.
 - b. Shrub areas without ground cover: The rough grade will be left 2 inches low prior to work of this Section.
- 2. Soil Mix: General Planting**
 - a. 1 part bedding mix
 - b. 1 part native soil
 - c. Add 4 pounds fertilizer per 100 square feet of bed area and cultivate 6 inches deep.
- 3. Shrub Beds without Ground Cover: Pocket planted with soil mix described above. Fertilize as above.**
- 4. Specimen or Individual Shrubs: Plant in pits twice the diameter and no deeper than the root ball, and backfill with soil mix described above.**
- 5. Refer to the Drawings for other soil preparation details, notes, and requirements.**

C. Perennials and Annuals

- 1. General: Refer to the Drawings for plant area locations.**
 - a. Perennial and annual planting areas: Rough grade in bed areas will be left 6 inches low prior to the work of this Section. Do not disturb existing seasonal color beds.
- 2. Soil Mix**
 - a. Perennial Beds
 - 1) 1 part bedding mix
 - 2) 2 parts decomposed pine bark
 - 3) Add 4 pounds fertilizer per 100 square feet of bed area and cultivate 6" deep.
 - b. Annual Beds
 - 1) 1 part sandy loam
 - 2) 2 parts decomposed pine bark
 - 3) 1 part sharp sand
 - 4) 1 part peat moss
 - 5) Add 4 pounds fertilizer per 100 square feet of bed area and cultivate 6 inches deep.

3.3 TREE PLANTING

- A. Location: Refer to Drawings for location of trees. Stake and label position of trees before pits are dug. Receive approval from Owner's Representative before proceeding.
- B. General
 - 1. **Excavate pit. During pit excavation, if pit walls are glazed, roughen sides to allow for good bond with backfill.**
 - 2. **Center trees, with root flare at or above finish grade and with trunk plumb. Position tree and receive approval from Owner's Representative before removing burlap or backfilling.**
 - 3. **Remove top 1/3 of ball burlap immediately prior to backfilling pit, 2 hour maximum, and gently roughen exposed soil around ball, being careful not to damage feeder roots.**
- C. Size of Tree Pits: Plant in pits twice the diameter of the root balls (minimum ball diameter plus 2'-0") and no deeper or as otherwise detailed on the Drawings. Rest root ball on undisturbed soil except where a sub- drainage system is indicated. Carefully settle by watering to prevent air pockets.
- D. Maintain trees in vertical position while backfilling.

3.4 SPACING AND PLANTING SHRUBS AND GROUND COVERS

- A. Place plants in position on bed areas or in individual pits before cans or burlap have been removed. Obtain approval from Owner's Representative.
- B. Remove cans or top 1/3 burlap from balled and burlapped plants. Plant where located and approved, setting plants with root flares at or slightly above finish grade, and compact soil carefully around each plant ball.
- C. Water each plant thoroughly with hoses to eliminate air pockets. Carefully prune plants to remove dead or broken branches and hand-rake bed areas to smooth, even surfaces.
- D. Owner's Representative reserves the right to interchange or shift locations of plants prior to planting.

3.5 STAKING

- A. Refer to Drawing details for placement of stakes.
- B. Trees over 6 inches DBH: No staking required.
- C. Trees under 6 inches DBH: Use 3 or more wires, attached to tree by loops of wire covered by 3/4 inch rubber hose, and secured around the lowest crotch. Anchor wire to "T" posts, driven into the ground to a depth of 20 inches.
- D. Inspect hose and wire attachments regularly to evidence of girdling or other damage, and adjusted before such damage occurs.
- E. Warning Flags: Flag guy wires or cable with plastic surveyor's ribbon to warn pedestrians. Do not place guy wires and cable across paths or sidewalks.
- F. At direction of Owner's Representative, leave some trees unstaked for reasons of sheltered location or large relative size of root ball.
- G. At the direction of Owner's Representative, stake certain large shrubs for reasons of exposure to prevailing winds or small size of root ball in relation to top growth.

3.6 MULCHING

- A. After work of planting has been completed and approved by Owner's Representative, mulch soil in and around tree pit and bed areas with 2 inch thickness of shredded pine bark, lightly cultivated into area. Do not disturb watering saucer, and do not cover root flare. Delay this operation until just prior to final inspection.

3.7 FINE GRADING

- A. Loosen ground cover areas and fine rake to break up lumps and produce a smooth, even grade free from unsightly variations, ridges or depressions.
- B. Remove and legally dispose off site stones 1/2 inch or larger, sticks, root or other debris that is exposed during this operation.
- C. Fine Grading: Subject to approval by Owner's Representative.
- D. Ensure positive drainage away from building at planting areas adjacent to the building.

3.8 CLEAN UP

- A. During work, keep premises neat and orderly including organization of storage areas. Remove trash, including debris resulting from removing weeds or rocks from planting areas, preparing beds, or planting plants, from site daily as work progresses. Keep walk and driveway areas clean by sweeping or hosing.

END OF SECTION

33 06 70 – ELECTRICAL UTILITY SERVICES

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

- A. For Utility Supplied Services - System Characteristics: 120/208 volts, three phase, four-wire, 60 Hertz. System voltages shall match utility service.
- B. Self-generated voltages shall match system standard voltages.

1.2 QUALITY ASSURANCE

- A. Perform Work in accordance with Utility Company written requirements.
- B. Maintain one copy of each document on site.

1.3 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70 and IEEE 141.
- B. Products: Listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 PAD FOR UTILITY TRANSFORMER

- A. Description: Transformer pad sized as required by utility company.

PART 3 EXECUTION

3.1 PREPARATION

- A. Arrange with Utility Company to obtain permanent electric service to the Project. Pay for all required permits and fees.

3.2 INSTALLATION

- A. Install meter base as required by Utility Company. All wire, conduits, pads, meter bases, weatherheads, and meter not installed by utility company and required for a complete and functional electrical service.

END OF SECTION

PROJECT CLOSE OUT CHECK LIST

Observatory, Rancho Mirage, CA Project #: CP15-315

Date: _____

Record of Project Quality Control:

Electrical	_____	_____	_____	Confirmed by: _____
Mechanical	_____	_____	_____	Confirmed by: _____
Plumbing	_____	_____	_____	Confirmed by: _____
Finishes	_____	_____	_____	Confirmed by: _____
Fire Alarm Systems	_____	_____	_____	Confirmed by: _____
HVAC	_____	_____	_____	Confirmed by: _____
Lighting (controls)	_____	_____	_____	Confirmed by: _____
Landscaping (irrigation)	_____	_____	_____	Confirmed by: _____

City Electrical Inspector's Final Inspection:

Date: _____ Approval Date: _____ Confirmed by: _____

State or Local Fire Marshal's Final Inspection:

Date: _____ Approval Date: _____ Confirmed by: _____

Specialties Inspections:

Date: _____ Approval Date: _____ Confirmed by: _____

Final Building Inspection: *(Copy of Final Bldg. Inspection is required to be sent to the Architect)*

Date: _____ Confirmed by: _____

Substantial Completion:

Date: _____ Confirmed by: _____

Issuance of Certificate of Occupancy: *(Copy of C.O. is required to be sent to Architect)*

Date: _____ Confirmed by: _____

Contractor's Letter of Construction Warranty:

Start Date: _____ Completion Date: _____ Confirmed by: _____

(Use the same date as the owner accepts the project.)

Warranty 11-Month Inspection:

Scheduled Date: _____ Confirmed by: _____

Warranties:

Documentation that all applicable equipment manufacturers' and suppliers' warranties have been transferred to the District.

Documented Date: Warranty Start Date: End Date:

Electrical	_____	_____	_____	Confirmed by: _____
Mechanical	_____	_____	_____	Confirmed by: _____
Plumbing	_____	_____	_____	Confirmed by: _____
Carpet	_____	_____	_____	Confirmed by: _____
Fire Alarm Systems	_____	_____	_____	Confirmed by: _____
HVAC	_____	_____	_____	Confirmed by: _____
PA Systems	_____	_____	_____	Confirmed by: _____
Other	_____	_____	_____	Confirmed by: _____

Manufacturers' Operation and Maintenance Manuals *(Transferred to District)*

Received Date: _____ Confirmed by: _____

Operators' & Repairpersons' Training:

Training Date(s):

Electrical	_____	Confirmed by: _____
Mechanical	_____	Confirmed by: _____
Plumbing	_____	Confirmed by: _____
Carpet	_____	Confirmed by: _____
Fire Alarm Systems	_____	Confirmed by: _____
HVAC	_____	Confirmed by: _____
PA Systems	_____	Confirmed by: _____
Other	_____	Confirmed by: _____

Building Users' (Owner / Tenants) Training:

Date Completed: _____ Confirmed by: _____

Sign Off of Final Completion:

Architect and engineers: each discipline's professional shall sign off in writing that he has physically inspected the project and certifies that to the best of his knowledge it meets the specifications and design requirements in addition to any codes.

Date Completed: _____ Confirmed by: _____

Contractor: will certify in writing that he has constructed the facility in accordance with the plans and specifications.

Date Completed: _____ Confirmed by: _____

Release of Claims (Sub contractors & Suppliers):

Verification that all sub-contractors have submitted affidavit verification that no claims are pending.

Date Completed: _____ Confirmed by: _____

Release of Liens from General Contractors:

Date: _____ Confirmed by: _____

Contractor Turns Over Keys and Lock Combinations:
Date: _____ Confirmed by: _____

Public Advertisement of Final Notice of Acceptance: *(Copy of advertisement is required to be sent to Architect)*
Dates(s) of Advertisement: _____ Confirmed by: _____

Project Turnover Memorandums:
Utilities Date: _____ Confirmed by: _____
Communications Date: _____ Confirmed by: _____
Building Insurance Date: _____ Confirmed by: _____
Others Date: _____ Confirmed by: _____

As-Built Drawings: *(As-Built Drawings are required to be sent to the SFD).*
Received Date: _____ Confirmed by: _____

Request for Final Payment:
Date of Request from Contractor: _____
Date of Request from SD to SFD: _____
Date Paid by SFD to SD: _____
Date Paid to Contractor: _____ Confirmed by: _____

Consent of Surety: *(To release final payment to the contractor.)*
Name of Surety: _____
Address of Surety: _____
Telephone Number of Surety: _____
Date Received: _____ Confirmed by: _____

Contractor's Request for Release of Retainage: *(Copy required to be sent to SFC)*
Date of Request: _____
Date of Completion: _____ Confirmed by: _____

Project Accounts:
Letter to Owner: Date: _____
Finalize all billings: Date: _____ Confirmed by: _____
Close all accounts: Date: _____ Confirmed by: _____
ATM entries / revert monies: Date: _____ Confirmed by: _____
IET surplus monies back to the State Auditor's Office: Date Completed: _____ Confirmed by: _____

Archive Project Records: Confirmed by: _____
Scheduled date: (30 days after last activity)
Date Completed: _____

Confirmed by:

Please submit a completed copy of this Form 604 to the Architect to officially close the project records.

CONCRETE DESIGN MIX SUBMITTAL

Project: Observatory

City: Rancho Mirage, California

General Contractor: _____

Concrete Contractor: _____

Concrete Strength (Class): _____

Use (describe): _____

Design Mix Information

Please Check One

Based on Standard Deviation Analysis
Trial Mix Test Data

Design Characteristics:

Density	<input type="text"/>	pcf
Strength	<input type="text"/>	psi (28 day)
Air	<input type="text"/>	% specified

*If trial mixes are used the Mix Design is proportioned to achieve $f'_{cr} = f'_c + 1200$ psi
(1400 psi for strength higher than 5000 psi at 28 days)*

<u>MATERIALS</u>	Type/ Source	Specific Gravity	Weight/lb.	Absolute Vol. cu. ft.
Cement				
Flyash				
Microsilica				
Coarse Aggregate				
Fine Aggregate				
Water				
Other				
TOTAL				27.0 cu. ft.

* Water/Cement Ratio (lbs. water/lbs. cement) = _____ %

ADMIXTURES	Manufacturer	Dosage oz/cwt
Water Reducer		
Air Entraining Agent		
Mid Range Water Reducer		
Fibrous Reinforcement		
Other		

Slump before HRWR _____ inches

Slump after HRWR _____ inches

Standard Deviation Analysis (from experience records):

# of Test Cylinders Evaluated:	
Standard Deviation:	

$$f'_{cr} = f'_c + 1.34s \text{ or } f'_{cr} = f'_c + 2.33s - 500$$

(Refer to ACI 301 for increased deviation factor when less than 30 tests are available)

LABORATORY TEST DATA

Compressive Strength

Age (days)	Mix #1	Mix #2	Mix #3
7	psi	psi	psi
7	psi	psi	psi
28	psi	psi	psi
28	psi	psi	psi
28 average	psi	psi	psi

REQUIRED ATTACHMENTS:

Please Check

<i>Coarse Aggregate Gradation Report</i>	
<i>Fine Aggregate Gradation Report</i>	
<i>Concrete Compressive Strength Data or Trial Mixture Test Data</i>	
<i>Admixture Compatibility certification letter</i>	
<i>Rapid Permeability that results per AASHTO T277</i>	

SPECIAL INSPECTION AND TESTING AGREEMENT

Submitted by:

Name: _____

Address: _____

Phone #: _____

Main Plant Location: _____

Miles from Project: _____

Secondary Plant Location: _____

Miles from Project: _____

Date: _____

To permit applicants of projects requiring special inspection and/or testing per Section 1704 of the 2013 California Building Code (CBC):

Project: Observatory, Rancho Mirage, CA

Permit No.: _____

BEFORE A PERMIT CAN BE ISSUED: The owner, or the registered design professional in responsible charge, acting as the owner's agent, shall complete two (2) copies of this agreement and the attached Special Inspection and Testing Schedule, including the required acknowledgments. A preconstruction conference with the parties involved may be required to review the special inspection requirements and procedures.

APPROVAL OF SPECIAL INSPECTORS: Special inspectors may have no financial interest in projects for which they provide special inspection. Special inspectors shall be approved by the building department prior to performing any duties. Special inspectors shall submit their qualifications and are subject to personal interviews for prequalification. Special inspectors shall display approved identification, as stipulated by the building official, when performing the function of special inspector.

Special inspection and testing shall meet the minimum requirements of California Building Code Section 1704. The following conditions are also applicable:

A. Duties and Responsibilities of the Special Inspector

SPECIAL INSPECTION AND TESTING AGREEMENT

1. **Signify presence at jobsite.** Special inspectors should notify contractor personnel of their presence and responsibilities at the jobsite. If required by the building official, they shall sign in on the appropriate form posted with the building permit.
2. **Observe assigned work.** The special inspector shall observe assigned work for conformance with the building department approved (stamped) design drawings and specifications and applicable workmanship provisions of the International Building Code. Architect/engineer- reviewed shop drawings may be used only as an aid to inspection.

For continuous special inspection, the special inspector shall be on site at all times observing the work requiring special inspection. Periodic inspections, if any, must have prior approval based on a separate written plan reviewed and approved by the building department and the registered design professional in responsible charge. Periodic inspection is intended to mean that the inspector at periodic times inspects all work performed but is not required to “witness” the work being performed.

3. **Report nonconforming items.** The special inspector shall bring nonconforming items to the immediate attention of the contractor and note all such items in the daily report. If any item is not resolved in a timely manner or is about to be incorporated in the work, the special inspector shall immediately notify the building department by telephone or in person, notify the registered design professional in responsible charge and post a discrepancy notice.
4. **Provide timely reports.** The special inspector should complete written inspection reports for each inspection visit and provide the reports on a timely basis determined by the building official. The special inspector or inspection agency shall furnish these reports directly to the building official, registered design professional in responsible charge and others as designated

SPECIAL INSPECTION AND TESTING AGREEMENT

(see CBC Section 1704.1.2). These reports should be organized on a daily format and may be submitted weekly at the option of the building official. Examples of daily and weekly report forms are included in Appendix A. These reports should include:

- a. Description of daily inspections and tests made with applicable locations;
- b. Listing of all nonconforming items;
- c. Report on how nonconforming items were resolved or unresolved as applicable; and
- d. Itemized changes authorized by the architect, engineer and building official if not included in nonconforming items.

5. **Submit final report.** The special inspector or inspection agency shall submit a final signed report to the building official stating that all items requiring special inspection and testing were fulfilled and reported and, to the best of his/her knowledge, in conformance with the approved design drawings, specifications, approved change orders and the applicable workmanship provisions of the California Building Code. Items not in conformance, unresolved items or any discrepancies in inspection coverage (i.e., missed inspections, periodic inspections when continuous were required, etc.) shall be specifically itemized in this report.

B. Owner Responsibilities. The project owner, the registered design professional in responsible charge or an agent of the owner is responsible for employing special inspection services. The special inspector/agency shall not be in the employ of the contractor, subcontractor or material supplier (see CBC Section 1704.1). In the case of an owner/contractor, the special inspector/agency shall be employed as specified by the building official.

C. Registered Design Professional in Responsible Charge Responsibilities

1. Prepare special inspection program. The registered design professional in responsible charge shall list the items for which special inspection is required and shall indicate which, if any, items for which the IBC or the building official approves periodic inspection and the frequency of such inspection.
2. Respond to field discrepancies. The registered design professional in responsible charge shall respond to uncorrected field deficiencies in design, material or workmanship observed by the special inspector.
3. Review shop drawings and submit design changes. The registered design professional in responsible charge shall acknowledge and approve shop drawings that may detail structural information, shall submit to the building official and to the special inspection agency written approval of any verbally approved deviations from the approved plans and shall submit revised plans for building official approval as required.

D. Contractor Responsibilities

1. **Notify the special inspector.** The contractor is responsible for notifying the special inspector or agency regarding individual inspections for items listed on the attached schedule and as noted on the building department approved plans. Adequate notice shall be provided so the special inspector has time to become familiar with the project.
2. **Provide access to approved plans.** The contractor is responsible for providing the special inspector access to approved plans.

SPECIAL INSPECTION AND TESTING AGREEMENT

- 3. **Retain special inspection records.** The contractor is also responsible for retaining at the jobsite all special inspection records completed by the special inspector upon request.

E. Building Department Responsibilities

- 1. **Approve special inspection program.** The building department shall approve all special inspectors and special inspection requirements.
- 2. **Enforce special inspection.** Work requiring special inspection and the performance of special inspectors shall be monitored by the building inspector. His/her approval must be obtained prior to placement of concrete, covering of structural steel or other similar activities in addition to that of the special inspector.
- 3. **Review inspection reports.** The building official should review special inspection progress and final reports.
- 4. **Perform final inspection.** The building official should perform the final inspection and approval for a project after the final special inspection report has been reviewed and approved.

ACKNOWLEDGMENT

I have read and agree to comply with the terms and conditions.

Owner: _____

_____	By: _____	Date: _____	Project Engineer/Archite
_____	By: _____	Date: _____	Soils Engineer:
_____	By: _____	Date: _____	Contractor:
_____	By: _____	Date: _____	Special Inspector or Insp
_____	By: _____	Date: _____	

ACCEPTED FOR THE BUILDING DEPARTMENT

By: _____

Date: _____

nRE

Owner's Project Requirements

Observatory

Rancho Mirage, California

CAL Green compliance package

Date of original: September, 2015

Date of this version:

This version approved by: _____

Owner’s Project Requirements

Observatory City Project #CP15-315

Rancho
Mirage,
California

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1. Overview and Scope

1.1 Overview and Definition

The Owner's Project Requirements (OPR) provide an explanation of the ideas, concepts and criteria that are considered to be very important to the owner, coming out of the programming and conceptual design phases and which are desired to be tracked throughout design and construction. The OPR is developed by the owner, not the design team. The OPR provides the direction for the design team.

The OPR document sets the functional goals that the design is judged against and establishes the basis of the criteria used during construction to verify actual performance. The OPR does not necessarily list items that are already required by code. The OPR is generally not a description of what specifically will be included in the project design, but is the more general feature and categorical performance criteria to be met by the design. Where practical and known, the OPR includes measurable indicators used to verify that the performance requirements were met.

The OPR will be followed by the basis of design or design narrative written by the design team and included with design package submissions. The basis of design documents the primary thought processes and assumptions behind the design decisions and describes the design elements being incorporated to meet the OPR.

1.2 Scope

This document includes requirements for the systems to be included under the formal commissioning umbrella or be impacted by their interactions. For reference, systems not included in this OPR that are typically not of concern to Cal Green commissioning, may but not necessarily limited to process mechanical and plumbing, paging, automatic doors and gates, presentation screens, and some other moving mechanical devices.

This document is not a comprehensive project OPR, and does not include all project requirements and directives to the design team but does essentially cover the following aspects.

- a. Environmental and sustainability goals.
- b. Energy efficiency goals per California Energy Code section 120.8(b)
- c. Indoor environmental quality requirements.
- d. Project Program
- e. Equipment and Systems expectations.
- f. Building occupant and operation / maintenance (O and M) expectations

This document focuses on the mechanical, energy and comfort related systems and on the sustainability requirements of the project. Other areas impacted by commissioning or commissioned systems are covered more broadly. The design areas included in this document are:

Covered More Thoroughly

- Heating, ventilating & air conditioning (HVAC)

- Electrical
- Sustainability
- Commissioning

Covered Peripherally

- General requirements
- Design process
- Building envelope
- Fire alarm
- Plumbing
- Data and communications
- Security and access

1.3 Format

Under each area or building system is a list of pertinent questions and data needed to be answered. Blue, indented italicized text indicates the answers to the questions and specific information about the project requirements for this project.

1.4 OPR Process and Tracking

The following table lists the design areas and the party assigned to fill in the OPR and its current status. Track changes should be used for all versions after the initial.

Design Area	Responsible Party for OPR Input	Status of Input
Overview and Scope	owner	reviewed / approved
General Requirements	owner	reviewed / approved
Design Process	architect	reviewed / approved
HVAC	architect / owner	reviewed / approved
Electrical	architect / owner	reviewed / approved
Sustainability	commissioner	reviewed / approved
Building envelope	architect	reviewed / approved
Plumbing systems	architect / owner	reviewed / approved
Fire alarm	architect	reviewed / approved
Data and communications	architect	reviewed / approved
Security and access	owner	reviewed / approved

Updating Required: The missing information will be updated when this data is submitted.

2. General Requirements

2.1.1.1 What are the general overall objectives of this project?

The Observatory is designed to be a smart complex with compelling spaces, and high-end service facilities. Comprehensive energy efficiencies will be integrated in a whole building systems approach to significantly reduce carbon dioxide emissions and create an “intelligent building” that is both environmentally, and socially, responsible.

2.1.1.2 Describe the existing conditions of the site.

The site takes up an intersection corner and is now vacant in the fringes of a major City Library with adjacent mixed uses.

2.1.1.3 What type of activities/functions will occur in this facility?
(Provide a general overview. The space planning / utilization is included in another document by the Architect).

Parking, Education, Research

2.1.1.4 What type of facility culture does the owner want designed into the facility (corporate, office, formal, relaxed, business, leisure, academic, natural, etc.)? Explain for each type of occupancy.

Academics and research.

2.1.1.5 How many square feet of floor area is planned for each of the use types (retail, parking)? How flexible are the totals and the fraction of each?

See floor area summary:

2.1.1.6 What are the floor number and/or building height requirements, desires and limitations?

35 ft. height with theme \observatory dome.

2.1.1.7 What is the proposed facility's life expectancy?

100 years

2.1.1.8 What future flexibility in function/activities must this facility accommodate?

TBD.

2.1.1.9 The building houses office occupancies. Are spaces anticipated to be converted from one use to another? *No*

- 2.1.1.10 How long does the current owner intend to own this building?
Owner / city is continuous.
- 2.1.1.11 Will the Owner operate and maintain the building?
The owner operates and maintains all their assets.
- 2.1.1.12 What frequency of change will the building undergo during its lifetime?
Owner would expect normal continuous use.
- 2.1.1.13 What type of changes and tenant fit-up are envisioned?
NA
- 2.1.1.14 What are the overall energy efficiency goals and objectives? (ASHRAE 90.1, State Code, Energy Star, other indices, this building's past performance, etc.)
Use of HVAC systems with an energy efficiency goal supporting CAL Green and 2013 CEC Title 14 minimum requirements while achieving mandatory and performance goals. (2/9/2015 update)
- 2.1.1.15 What other environmental goals and requirements are there?
*A building that will provide environmental control utilizing sustainable design practices in the pursuit of achieving CAL Green compliance and possibly better. Incrementally the building design shall include **planning** for future work, implementing space on the roof for solar panels to eventually achieve the 2030 Challenge resulting in almost zero fossil fuel based energy. Structural Roof Loads (8 # / s.f.) are added to the dead-load criteria for future solar panels installed on the roof. Additionally, stub-outs and conduit runs from future circuits are a part of the infrastructure to handle it. (2/9/2015 update)*
- 2.1.1.16 What are the objectives relative to the local neighborhood?
*There is a direct correlation between urban density and energy consumption as density promotes walking, cycling, and mass transit as alternatives to driving.

Effectively, a dense development in this location leverages the City's significant investments.*
- 2.1.1.17 What are the challenges relative to the local neighborhood and adjacent buildings?
A traffic study was conducted and concluded there would be no significant adverse traffic or parking impacts. This traffic analysis was both required and approved by the City Design Review Commission.
- 2.1.1.18 What direction is intended for the front of the building to face?

How much latitude is in this? *Front: south*

- 2.1.1.19 Describe the expected phasing of the project for construction, tenant fit out and occupancy? Include descriptions for each of the occupancy types.

NA

3. **Design Process**

3.1 **Basis of Design**

Documentation

Describe the requirements for the design team to develop the design (including design narratives and design rationale) for the various design packages.

With each design submission the design team will include a written basis of design. This will be updated and become more detailed with each successive submission. The basis of design includes two primary elements—a design narrative and the design rationale.

During the schematic design phase the design narrative is the written description and discussion of the concepts and features the designer intends to incorporate into the design. In subsequent design phases the design narrative is a description of what they have incorporated to meet the owner's project requirements and associated performance. The design rationale is the basis, rationale and assumptions for calculations, decisions, schemes and system and assemblies selected to meet the owner's project requirements and to satisfy applicable regulatory requirements, standards and guidelines.

3.2 **Design Reviews**

- 3.2.1.1 Describe the expected design reviews and the expectations of the design team regarding responding to comments.

There will be owner review for commissioned systems for each design submission. The design team will respond in writing to each comment and will consult with the Owner on issues that may increase scope, project budget or timeline beyond what they feel the Owner may desire. Reviewer comments will be responded to and comments with questions or disagreements between reviewers and the design team will be adjudicated prior to proceeding with impacting portions of the next design phase, unless directed by the Owner. Additionally, the owner has been made aware that the commissioning scope will vary in accordance with tenant demands and local jurisdiction criteria. Design review by the commissioner may or may not be mandated by these circumstances.
(2/9/2015 progress update)

4. **Heating, Ventilating and Air Conditioning**

4.1 **Occupancy, Climatic, Temperature and Sizing Requirements**

- 4.1.1.1 **Time of day schedules.** List tenant types with their time of day and days of week they occupy.

Office (RE or Insurance): 6am – 6pm M-S.

- 4.1.1.2 List and describe any spaces that will require night time operation. Indicate how often and how long this after hour's occupancy is likely to be.

All areas shall have local override capabilities for the HVAC and lighting to allow after hours occupancy. Override should be accomplished from local override switches in the space. In general, this after-hours operation is expected to be rare lasting from a few hours to all night. However, there shall be a 5,000 sf of flexible space, yet to be determined, that will possibly house a child-care facility that will require possible full time operation.

- 4.1.1.3 **Climatic design criteria.** What climatic conditions shall the HVAC systems be designed to--ASHRAE 0.4%, 1% or 2% (the latter being more typical and assumes less extreme weather).

ASHRAE 2%. / California Climate Zone

- 4.1.1.4 **Temperature and humidity.** List the interior temperature and relative humidity conditions that must be maintained for each tenant or occupancy type. List any special conditions or spaces.

Relative humidity: All temperatures within a given space should be compliant with ASHRAE 55 standards of 5F in the occupied zone.

Retail spaces: 68F heating, 75F cooling, <55%

RH. Office areas: 68F heating, 75F cooling,,

<55% RH.

- 4.1.1.5 **Tolerances.** List the space temperature and humidity tolerances that each space type must stay within during occupied hours.

The HVAC system shall control the temperature in all spaces to within +/-3F of the given heating and cooling set points.

- 4.1.1.6 **Air Drafts.** How tolerant are the occupants expected to be of noticeable HVAC air movement—none, little, some, moderate.
The occupants of this Class A retail development will have little tolerance for drafts.
- 4.1.1.7 **Diversity.** Is it OK to plan for reasonable diversity—typically around 85%—that is, the assumption and likelihood that not all spaces will experience worst case load conditions at the same time?
Assume moderate diversity in both heating and cooling for interior spaces. For perimeter spaces, assume only a small diversity for heating. For perimeter spaces on a given orientation, assume only a small diversity for cooling.
- 4.1.1.8 **Redundancy.** What redundancies are desired for specific HVAC services (chilled water, hot water, space air temperature, humidity, air quality) and why?
NA

4.2 Air Quality and Ventilation

- 4.2.1.1 What are the goals and requirements for indoor air quality--standard, above average, exceptional? List any special requirements.
To maintain ventilation standards as stated by ASHRAE 62.1 2004 while maintaining thermal comfort. Air handlers will be required to be filtered to reduce dust buildup on system components. Building flush out is required to meet CAL Green requirements.
Generally the goal is to have above average air quality.
- 4.2.1.2 What are some of the methods considered valid for meeting these goals? (ASHRAE and codes, higher than code required minimum levels of natural ventilation (with associated higher energy costs), additional filtration (with associated higher fan energy and O&M costs), minimizing outdoor air ventilation rates with demand controlled (CO₂) ventilation (to minimize energy use), reducing indoor contaminants).
Minimum ventilation requirements as stated in ASHRAE Standard 62.1 2004 and meet thermal comfort requirements as stated in ASHRAE Standard 55-

2004. Use (where recommended by design engineer) demand control ventilation. CO2 monitors in high occupancy areas.

4.2.1.3 What guidelines should be referenced and applied as much as reasonable for this project?

Indoor Air Quality Guide, ASHRAE / CAL Green Code Standards

- 4.2.1.4 Will there be rooms that store bulk quantities of flammable, combustible, radioactive, or biological materials?
No.
- 4.2.1.5 Where are operable windows acceptable (office, retail, medical)? Where are operable windows desired? Are patio doors desired?
Acceptable in Child Care
- 4.2.1.6 Where, if any, will smoking be permitted in the building?
No smoking.
- 4.2.1.7 What level of air flow separation is desired between condominiums to control odors (standard, above standard, exceptional)?
Exceptional. Makeup air supply and slight pressurization will negate the need for additional odor control.
- 4.2.1.8 What level of air flow separation (from common mechanical system air and natural air leakage) is desired between restaurants and adjacent spaces to control odors (standard, above standard, exceptional)?
No common system will be utilized.

4.3 General HVAC Systems Data

- 4.3.1.1 What system types and brands are not desired or are not acceptable?
No system types or brands have been identified as preferred or excluded.
- 4.3.1.2 What system types or brands are mandatory?
No system types or brands have been identified as preferred or excluded.
- 4.3.1.3 Is larger central equipment desired over smaller more numerous distributed equipment? (Central equipment typically is easier to maintain, but requires vendor support, lasts longer, is more energy efficient, but may cost more.)
Because of multiple commercial tenants, staged fit out and individual tenants, smaller distributed equipment is preferred.

4.4 Design Calculation and Tools

- 4.4.1.1 List the requirements for engineering calculations and

assumptions.

The A/E shall perform industry standards in determining the mechanical design. Recognized computation techniques shall be used when necessary. All assumptions shall be clearly stated with supporting referenced documents. Load calculations may be necessary for certain tenant improvements such as food service and medical. When done, they shall be properly indexed and bound, signed, and dated by the designer and checker; approved and stamped by a registered professional holding a valid license and presented as part of the design package.

(2/9/2015 progress update)

4.4.1.2 List any special design guidelines or standards besides ASHRAE 62

Air Quality, ASHRAE 90.1 Energy, NFPA 101 and 110 Fire and Emergency Power and applicable state codes and standards that should be used in designing this building with appropriate elements incorporated.

ASHRAE Advanced Energy Design Guidelines / Overall efficiency of building shall meet California energy code and exceed minimum 12% better than ASHRAE 90.1-2007 standards.

Note: Air conditioning equipment must be manufactured after 1/1/2015 meeting the applicable minimum efficiency values as determined by Title 20 California Code of Regulations Section 1605.1. State Standards are the same as Federal regulations pursuant to NAECA or EP-Act which prevents the sale of unapproved or unlisted appliances.

HVAC equipment efficiency and characteristics:

All R.T.U. (roof-top-units) shall meet the following or per California Standards):

- 1. 6 tons and less = (minimum 15 SEER) with R-410a refrigerant shall be used.*
- 2. Greater than 6 tons = 12.0 EER*

Units shall be equipped with an economizer. Investigation will be required to determine the feasibility, local regulations and requirements for the HVAC to interface with fire alarm system when required by the fire authority. The fire sprinkler consultant provides the shop drawings for review and to verify the fire alarm interface (generally required when 100 or more sprinkler heads are designed). The structural roof system design shall take into consideration the combined weight of the economizer and unit in the calculations. (2/9/2015 update)

4.4.1.3 What design tools are desired to be used for this project (standard 2-D computer-aided design, 3-D modeling of the exterior building shape, 3- D modeling of the mechanical, electrical and plumbing, 3-D modeling of the interior spaces and lighting levels, 3-D visualization of light levels)?

AutoCad / Revit

4.5 HVAC Budget Issues

- 4.5.1.1 What are the budget goals for the HVAC system (standard typical cost as % of entire design, OK to exceed the standard cost fraction if justified through life cycle cost analysis)?

Cost effectiveness is a general criteria for system selection but a percentage has not been specified.

4.6 HVAC Performance Requirements

- 4.6.1.1 Describe the general HVAC performance requirements.

All of the HVAC equipment should perform as described on the project plan and schedules with regards to capacities, pressure drops, efficiencies, etc. While the performance of every piece of equipment precisely to its rating may not be crucial to proper operation of the facility, there is specific equipment

whose performance is more vital. Central heating and cooling equipment, for example must be able to meet their intended performance ratings so that building temperatures can be maintained. Sequences of operation which are critical for maintaining precise pressure relationships must perform properly.

The commissioning process will establish that critical equipment and systems perform properly when the building is turned over to the owner. Carefully planned and executed maintenance programs will help ensure that the systems and equipment continue to function as intended over time.

- 4.6.1.2 Capacity for the following systems shall be verified through a) certified factory testing of units shipped, b) field tests, or c) via ARI ratings only (specify). (e.g., Air handler or roof top DX unit cfm, cooling coil capacity or, heating coil capacity. Chiller, cooling tower or boiler heating or cooling capacity.) List.

ARI ratings are acceptable for all equipment.

- 4.6.1.3 Efficiency for the following systems shall be verified through a) certified factory testing of units shipped, b) field tests, or c) via ARI ratings only (specify). (e.g., DX unit EER, boiler efficiency, chiller kW/ton). List.

ARI ratings are acceptable for all equipment.

4.7 Energy Efficiency and Demand Reduction

4.7.1.1 The goals and targets of *overall building* energy efficiency are given in the Sustainability section under Energy Efficiency.

4.7.1.2 List any specific HVAC energy efficiency features or equipment desired or required for this project.

Overall efficiency of building shall meet California energy code and exceed minimum 12% better than ASHRAE 90.1-2007 standards.

4.7.1.3 What level of HVAC *equipment* energy efficiency are desired (standard, above standard, exceptional)?

The current equipment energy efficiency target to meet minimum code requirements. (2/9/2015 update)

4.7.1.4 Are power demand reduction features important? These include, listed from moderate to rigorous: staggering of equipment startup, active automatic load limiting, thermal energy storage, etc. List those required or of interest.

Staggering of equipment startup is sufficient.

4.8 Renewable Energy

4.8.1.1 Describe any renewable energy goals.

Project seeks to incrementally meet the requirements of the 2030 Challenge, to achieve carbon neutrality by 2030.

4.9 New Concepts and Systems

4.9.1.1 Would incorporating new or relatively untried systems and equipment be seriously considered (no, possibly, likely)?

No.

4.10 HVAC Flexibility for Tenant Churn

4.10.1.1 What are the requirements for flexibility in the HVAC systems to accommodate changing floor layouts and occupancy needs (normal, above average flexibility, very flexible. List the areas that apply or any special needs)?

Zones will be able to be added as deemed necessary. HVAC design must be intentionally flexible.

We have two retail tenants on 20 year term leases, with 20 year renewals

Retail HVAC flexibility is also very important.

4.11 Maintainability

- 4.11.1.1 What are the maintainability objectives for the HVAC equipment (standard level, above standard, exceptionally easy to maintain)?

Require all pumps, motors, terminal units and associated equipment to be easily accessible to maintenance staff. Goal is to be above standard.

- 4.11.1.2 Is it expected that there will be normal, above normal or exceptional accommodation for replacement of chillers and air handlers?

Normal.

- 4.11.1.3 How much desire is there for top of the line equipment features that simplify and make maintenance easier? (e.g., hinged access doors, filter pressure monitoring, direct expansion equipment with refrigerant hose access plugs and taps, hose bibs on roof, lights in cabinets, service outlets in units or nearby, etc.). Little, some, significant.

Significant.

4.12 Reliability and Durability

- 4.12.1.1 What are the reliability and durability objectives for the HVAC equipment (standard level, above standard, exceptionally reliable)? Would this include smaller components like dampers, actuators, valves, sensors, etc. and not just the larger equipment.

Provide equipment with at least 1 year warranty. Temperature, CO2, and airflow monitoring devices to be calibrated and factory tested before installation. Above standard reliability and durability of major and smaller components are desired.

4.13 Operations and Maintenance Documentation

- 4.13.1.1 Are electronic O&M manuals desired?

Yes.

4.14 Recommendations (by Commissioner) (2/9/2015 update)

- 4.14.1.1 Clarify if HVAC interfaces with fire alarm:

Yes or possibly: The Fire Marshall shall make a determination during

the tenant improvement design based on the area and sprinkler head amount.

4.14.1.2 Incorporation of LEED for possible timeline.

Doubtful: The project owner has found no economic value in LEED and thus the utilization of this criteria will not be used.

4.14.1.3 Incorporation of Vibration and Seismic

Yes or possibly: Seismic considerations for equipment anchorage is considered by the structural engineer consultant. Vibration is considered as recommended by equipment manufacturer or incorporated in the equipment.

4.14.1.3 Project Budget and Schedule

The project is scheduled for city planning commission review on Feb. 22. The construction bidding, selection of contractor, building department plan check and approvals, civil engineering reviews and approvals and final city council project approvals determines start of construction. Estimation start-up is April 1 and completion of shell buildings and site work is the end of 2015.

4.13.1.2 Are single-line system flow diagrams beyond the control diagrams desired to be provided for O&M staff of the primary systems? List-- chilled water, process water, heating hot water, air handlers, cross section air riser diagrams of floors' supply, return and exhaust flows, etc.

Yes. All listed.

4.13.1.3 What comprehensiveness of Systems Manual is desired (minimum, moderate or very comprehensive)? The Systems Manual describes the operational (in contrast to maintenance) procedures for the systems and equipment and building as a whole—system flow diagrams, set points, strategies for seasonal control optimization, shutdown procedures, emergency procedures, energy optimization and tracking recommendations, retesting and calibration methods and frequencies, etc.

Very comprehensive.

4.14 Training

- 4.14.1.1 Who will be operating the building HVAC and electrical systems? (in- house staff, outsourced staff)
In-house staff.
- 4.14.1.2 How much equipment will be maintained by equipment vendors vs. in- house staff?
All equipment will be maintained by in-house staff except for significant issues with major equipment like chillers and built-up air handlers which will be handled by equipment vendors.
- 4.14.1.3 What level of training is desired for the in-house staff for operating and maintaining the systems and assemblies of the building?
All staff will be new to this building. A comprehensive level of training is desired.
- 4.14.1.4 How much of the training is desired to be video recorded? [All, most, some.]
Most systems will have their trainings recorded.
- 4.14.1.5 Is it desired to have the engineer and architects provide some orientation / training on the primary mechanical and electrical systems?
Yes.

4.15 Building Automation System (BAS) and Controls

- 4.15.1.1 Are there special owner control system standards that need to be followed?
No.
- 4.15.1.2 What sophistication is desired in the control system (standard, above standard, exceptional)?
Standard
- 4.15.1.3 Are control schematic diagrams of all controlled equipment required to be in the design documents, or will the sequences of operation suffice?
Control schematics required for all equipment.
- 4.15.1.4 Is a specific controls points list required in the design documents that lists each point and whether it's a binary or analog input or output and the equipment it is tied to, or is the contractor required to determine control points from the specified features and sequence of control?

Points list required.

- 4.15.1.5 What level of detail is desired for the control sequences of operation to be included in the design documents—moderate, above standard, very detailed? Detailed sequences are finely numbered and include:

overview narrative, interactions, interlocks, delineation of control with packaged controllers, startup, warm up, cool down, occupied, unoccupied, optimal start/stop, capacity control, staging, set points, setbacks, setups, resets, demand limiting, loss of network, loss of power, alarms, delays, etc. and result in fewer questions of, and require only limited adjustment by the controls contractor.

Require detailed sequences.

- 4.15.1.6 For the operator's interface screens, how many summary tabular screens of conditions of grouped equipment are desired (e.g., air terminal unit zone: cfm design and actual, space temperature set and actual, discharge temperature. All air handlers, etc.). Few, some, many?

Many.

- 4.15.1.7 What control systems are not acceptable?

Wireless may not be desirable. Mechanical designer to provide list of approved manufacturers.

- 4.15.1.8 What control systems are mandatory or highly desirable?

No control system types or brands have been identified as preferred or excluded.

- 4.15.1.9 List any control element type or brand that is not to be used.

Paddle type flow meters are not to be used in the open condenser loop system. Paddle or blade type flow switches are not to be used anywhere.

- 4.15.1.10 Is a web-based accessible system desired?

Yes.

- 4.15.1.11 Will the control system need to tie into another existing building automation control system from another building? Explain.

No?

- 4.15.1.12 How much is desired to be included in one integrated work

station monitor (HVAC, lighting, fire, security), vs. separate monitors and work stations?

There may be separate controllers or systems, but there should be some monitoring between them. See subsequent questions below.

4.15.1.13 Describe interlocks to the HVAC system from the Security System.

The HVAC OWS will not monitor any security elements other than three levels of general security alarms.

4.15.1.14 Describe interlocks to the HVAC system from the Fire Alarm System.

Fire alarm system is separate, except general alarms are passed to the BAS.

4.15.1.15 Describe interlocks to the HVAC system from the Lighting Control System.

The HVAC operator's work station (OWS) will control the HVAC and monitor the lighting schedules, but doesn't have to be able to change schedules, though that would be OK.

4.15.1.16 Describe interlocks to the HVAC system from the elevators.

An alarm in the elevator will be transmitted to the BAS and the security system for monitoring and the elevator sump pump alarm will be seen at the BAS.

4.15.1.17 How much interoperability communication between the central control system and the mechanical equipment is desired? (none, little, some, significant) Add details in the next article.

Some.

4.15.1.18 Interoperability Details.

For Primary equipment (chillers, main air-handlers) the BAS just monitors some? Comply with codes.

For primary equipment, the BAS passes set points and other commands to the equipment.

4.15.1.19 For the chiller and pumps are there any of these that will not require automatic changeover to the backup / lag piece without operator action should one piece of equipment fail?

No.

4.15.1.20 How fast should the refresh rate be on the operator's work station? (standard, above average, exceptional)

Standard.

4.15.1.21 What fraction of the BAS set points should be able to be adjusted from the OWS graphics screens? (none, few, some, most, all)

Most.

- 4.15.1.22 For non-measurement and verification (M&V) purposes, like energy optimization and troubleshooting, how many system monitoring points are desired, above that required to execute the sequences of control (none, some, many)?

Some.

- 4.15.1.23 Is there going to be a measurement and verification (M&V)--rigorous energy tracking, or significant ongoing commissioning program after occupancy, requiring numerous additional power and HVAC monitoring points?

No.

- 4.15.1.24 Is linking the sequences of operation and/or the O&M manual data to an icon in the graphic screen of each piece of equipment desired?

No..

- 4.15.1.25 How much expansion capacity is desired for adding control point inputs and outputs in each field control panel and primary controller? (none, 5%, 10%, 20%, etc.)

5%

- 4.15.1.26 Are there areas of the building that require essentially uninterrupted delivery of the HVAC (which would affect how the controls were designed)? List.

None.

- 4.15.1.27 Are there any critical areas that need their controllers to have redundancy in their power supplies?

No.

- 4.15.1.28 Upon a control system network failure should all equipment not being controlled by local controllers control to the last known value?

No.

- 4.15.1.29 Upon restoration of power after an outage, which equipment is allowed to require an operator to go to the equipment and reset it before it will start? Or require operator action at the workstation?

None to either.

- 4.15.1.30 Upon a general alarm that shuts down the equipment, upon the condition correcting itself, what equipment is allowed to or should require an operator to reset the unit at the

equipment? Or require action at the workstation?

None to either.

4.15.1.31 What other desires for the control system are there?

TBD

4.16 Occupant HVAC Control

- 4.16.1.1 What level of control is desired for the occupants to have over the temperature and ventilation in their space—list for each occupancy type (temperature adjustable by occupants at a zone thermostat, ventilation control adjustable by occupants for their specific area, temperature control adjustable only by facility staff, ventilation control adjustable only by facility staff)?

Office and Retail: Occupant accessible thermostats should all have timed override buttons in the office and retail areas for HVAC. Every 1,000 sf or so should have an override. The thermostat temperature should be adjustable by the occupant about +/-2F. No ventilation control by occupants, except if there are operable windows.

4.17 HVAC Acoustics --See Acoustics in the Sustainability section.

4.18 Entry Design

- 4.18.1.1 What level of minimizing drafts in and out of the main entrances are desired (standard, above standard, exceptional)?

Standard

- 4.18.1.2 What types of doorways that control drafts are desired or not acceptable?

Standard Storefront

4.19 Building Pressurization

- 4.19.1.1 Are there any building pressurization control schemes that are not acceptable, or that are mandatory?

No, project should have standard active positive pressurization.

5. Electrical Systems

5.1 General

- 5.1.1.1 List general requirements for the electrical system.

All electrical equipment will bear the UL label and no rebuilt, refurbished or remanufactured or used equipment or material shall be specified or installed. Complete raceway routing from panels to the field devices shall be indicated on the drawings for power, fire alarm,

security, PA, intercom and CCTV.

Complete 1-line power diagram(s) are required.

- 5.1.1.2 List any requirements for coordination studies (short circuit study, protective relays/breakers, voltage drop / transient study for large motors, etc.).

Short circuit study is required.

- 5.1.1.3 List requirements for connected and operating electrical load estimate, including future project loads, if applicable, lighting level calculations.

Both load calcs and lighting level calcs are required.

- 5.1.1.4 List any specific equipment brand or components that are to be included or not included in this project.

None.

5.2 Power Capacity

- 5.2.1.1 How much electrical capacity (W/sf) is desired for each type of space—standard for that type of space (typical), slightly above standard, moderately above standard, significantly above standard? List any specific capacity promised to office tenants.

All spaces should have a standard power density capacity provided.

5.3 Power Quality

- 5.3.1.1 What level of power quality are desired (standard, above standard, exceptional)?

Standard.

- 5.3.1.2 Are there any spaces that require special power quality requirements?

Unsure at this time and no special provisions. TBD in tenant improvement.

- 5.3.1.3 What level of safeguard is required to monitor and maintain the integrity (such as voltage or phase imbalance) of the incoming power (e.g. - protection of sensitive lab equipment)? What equipment or devices are included in the design to meet this requirement?

TBD

- 5.3.1.4 Are there special grounding and EMF mitigation requirements for these lab environments and equipment? What measures will be taken to mitigate?

TBD

5.4 Lighting and Visual Quality

- 5.4.1.1 What is the general level and description of the visual quality

desired in the facility? (standard, above standard, exceptional)?

Exceptional for lobby or entrance spaces; above standard for parking levels, with emphasis on minimizing glare while maintaining security and energy efficiency. Exceptional for office/medical units, should owner move forward with including lighting design in this Contract for interior design for these spaces.

- 5.4.1.2 Describe the level of aesthetic and artistic license for the lighting design for each of the occupancy types.

Aesthetic design will be made in close concert with the architectural and interior design and parking spaces.

5.5 Lighting Levels

- 5.5.1.1 Required average maintained light levels for this project are listed below. For spaces not listed, the current IESNA light level recommendations shall be followed.

CAL Green mandatory maximum light levels are required.

- 5.5.1.2 Would task lighting be an acceptable design feature required to achieve desired light levels in office areas?

Task lighting at workstations will be plug-in at discretion of the end-user. Where casework allows for integrated approach, under-counter lighting will be added.

5.6 Light Fixtures and Lamps

- 5.6.1.1 What level of energy efficiency is desired in the lighting equipment for each occupancy type (standard, above standard, exceptional)?

Standard

5.7 Lighting Control

- 5.7.1.1 What control of lighting is required in the various types of spaces (open office, closed offices, common areas, conference rooms, retail spaces, condominiums, exterior, parking garage, etc.)? Examples are manual switches to on, occupancy sensors to turn on or off, scheduled lighting controls and lighting sweeps and daylight dimming.

Meet or exceed exterior light levels and uniformity ratios for lighting zones 1-4 as defined in Chapter 10 of the California Administrative Code, CCR, Part 1.

Shield all exterior luminaires or provide cutoff luminaires

Contain interior lighting within each source

Allow no more than 0.01 horizontal lumen foot-candles to escape 15 feet beyond the site boundary.

Automatically control exterior lighting dusk to dawn to turn off or lower light levels during inactive periods.

5.7.1.2 Do any spaces have special glare requirements?

Exterior of building

5.8 Power Monitoring

5.8.1.1 Is sub-metering of utility power desired? (list for gas, electricity, water) What is the purpose of the monitoring of each? (Resource efficiency tracking, measurement and verification (M&V), occupant billing, demand reduction, etc.)

Sub-metering of electricity is desired for tenants as incentive to reduce energy use.

5.8.1.2 What is the intended level of metering and sub-metering? (Main switchgear only, or including metering of energy consuming sub- systems, such as HVAC central plant, AHUs, lighting panels, etc.)

TBD

5.8.1.3 How will the metered information be presented and reported for the occupants and staff? (Integrated with BAS, separate monitoring station, touch screen displays in lobby/common areas, etc.)

TBD

5.8.1.4 Are peak demand reduction strategies desired?

Yes

5.10 Power Metering and Billing for Tenants

5.10.1.1 What are the needs for sub-metering and billing of / for tenants?

225-amp, 480Y/277-volt meters for each retail space.

6. Commissioning

6.1 Scope

- 6.1.1.1 What systems are desired to come under the commissioning umbrella (HVAC and controls, electrical lighting controls, emergency generator, electrical equipment (switchboards, panel boards, transformers, motor control centers, etc. list), envelope, plumbing (domestic hot water system, circulation, sump and booster pumps, grey and rainwater reclamation, automatic valves and lavatories), irrigation, laboratory and clean room systems and supports, special systems (list), security system, data, intercom, CCTV, fire, life safety, fire alarm, etc.)

Current commissioning scope includes HVAC and controls, lighting controls, domestic hot water system, circulation, sump and booster pumps and HVAC interfaces with fire alarm.

6.2 Rigor

- 6.2.1.1 What level of rigor is desired for the commissioning process (typical, above average, very rigorous)? Discuss the rigor of design review, commissioning specifications, field observation and functional testing.

Current commissioning scope is for CAL Green compliance

Design Reviews. *During design this is characterized by a thorough independent design review of the commissioned systems and assemblies by qualified engineers focusing on commissioning, performance and O&M issues.*

Commissioning Specifications. *Commissioning specifications will be very thorough and fully describe all requirements of the Contractor, including specific testing requirements for each type of equipment. Roles of all parties and the sequence of the commissioning process will be clearly and completely described.*

Installation Verification. *During early and mid-construction the level of rigor is characterized by field observation by the Commissioning Authority or team, as necessary, to observe component and system installations for general progress and issues affecting performance and testing. Contractors are responsible for the installation, set up and startup of their equipment and filling out Commissioning Authority provided and all manufacturer provided checklists.*

***Performance Verification/Testing.** Performance verification shall be accomplished through review of control code programming, documented field testing of each sequence of operation for all equipment and through monitoring performance over time with trend logs from the building automation system. Testing will be conducted from detailed, step-by-step, repeatable test scripts specifically applicable to this project approved by the Commissioning Authority.*

In general, testing shall include testing each sequence in the sequence of operations, and other significant modes, sequences and control strategies not mentioned in the written sequences; including, but not limited to startup, shutdown, unoccupied and manual modes, modulation up and down the unit's range of capacity, power failure, alarms, component staging and backup upon failure, interlocks with other equipment, and sensor and actuator calibrations. All interlocks and interactions between packaged on-board controls, central control systems and other equipment shall be tested.

All larger, more complex or life-safety equipment will be individually tested. Testing only a sample of some equipment may be allowed where such equipment is small in physical size or importance, is numerous and is not complex or critical for life-safety (many smaller rooftop packaged units, air terminal units, exhaust fans, windows, etc.), as approved by the Commissioning Authority. When sampling is conducted a random spot check is required with sufficient sample size to provide reasonable confidence that the sampled results represent the entire population of units.

Tests for a given system or assembly shall not be conducted until they are fully operational under normal and reliable control with construction checklists, control calibrations, programming and control system graphics complete.

See related information in the HVAC Performance Verification Requirements section.

6.3 Objectivity

- 6.3.1.1 What level of objectivity and independence are desired for the commissioning process (typical, above average, significant)? Describe the independence of the Commissioning Authority, the reporting path of issues, how much testing the Contractor may do on their own, etc.

Current commissioning scope is for a typical level of objectivity.

***Commissioning Authority Access.** This is characterized by the*

commissioning authority having direct access to independently discuss issues with any party of the project team and by all issues identified by the commissioning team from initial identification being concurrently distributed directly to the Owner, Architect and Contractor.

Issue Management. *Issues are legitimate for identification and distribution when, 1) Any requirements as delineated in the contract documents are not being met, or 2) When significant elements of the Owner's Project*

Requirements are not being met). Issues shall be reported regardless of potential cost impacts to any party or potential impacts to the project schedule.

Testing. *All documented testing for complex equipment shall be directed and overseen by the Commissioning Authority or by another independent party, such as the fire marshal or a certified independent testing company (e.g., electrical equipment testing). Documented testing for less complex equipment and repetitive equipment (of large quantities, e.g., air terminal units) may be directed by the Contractor alone, as approved by the Commissioning Authority, with spot retests and test report review by the Commissioning Authority.*

7. Sustainability

7.1.1.1 What are the general sustainability goals for this project?

The project is required to comply with the CAL Green Building Standards Code.

7.2 Certifications

7.2.1.1 Describe any LEED or other certification goals and objectives.

The owner has researched the following incentives and discovered that the financially beneficial programs are no longer active.

LEED certification will no longer make the project eligible for the State Business Energy Tax Credits and Utility Incentives. The amount of incentive money available to the project is nonexistent. Thus only CAL Green performance and mandatory measures will be the clear objective.

7.3 Sustainable Siting and Planning

7.3.1.1 Provide the list of LEED sustainable siting and/or CALGreen Planning and Design features desired or required to be incorporated. List the LEED scorecard, if applicable.

The project shall, at a minimum comply with the City management requirements.

						Responsible Party Status		
SUSTAINABLE SITES								
Most Likely Possible Not Probable								
Y		SSp1	C	Construction Activity Pollution Prevention	KPFF	Open		
1		SSc1	D	Site Selection	GBS	Open		
1		SSc2	D	Development Density & Community Connectivity	GBS	Open		
1		SSc3	D	Brownfield Redevelopment	GBS	Open		
1		SSc4.1	D	Alternative Transportation, Public Transportation Access	GBS	Open		
1		SSc4.2	D	Alternative Transportation, Bicycle Storage & Changing Rooms	GBS	Open		
1		SSc4.3	D	Alternative Transportation, Low Emitting & Fuel Efficient Vehicles	GBS	Open		
1		SSc4.4	D	Alternative Transportation, Parking Capacity	GBS	Open		
	1	SSc5.1	C	Reduced Site Disturbance, Protect or Restore Habitat	--	Closed		
	1	SSc5.2	D	Reduced Site Disturbance, Maximize Open Space	--	Closed		
	1	SSc6.1	D	Stormwater Management, Quantity Control	--	Closed		
1		SSc6.2	D	Stormwater Management, Quality Control	KPFF	Open		
1		SSc7.1	C	Heat Island Effect, Non-roof	GBS	Open		
1		SSc7.2	D	Heat Island Effect, Roof	TVA	Open		
	1	SSc8	D	Light Pollution Reduction	--	Closed		
10	1	3	Total Points for Sustainable Sites					

Project shall NOT integrate LEED, only CAL Green compliance goals. The above table is for reference only.

7.4 Water Efficiency and Conservation

7.4.1.1 Describe the water efficiency goals of the project.

Project goal is to achieve a minimum 50% potable water use reduction for fixtures and toilets as compared to fixture requirements of the Energy Policy Act of 1992.

7.4.1.2 Is grey water recovery a consideration for this project?

Yes.

7.4.1.3 Is rainwater harvesting and use a consideration for this project?

No.

7.4.1.4 What level of low-water use landscaping is desired or would be considered?

There is not that much landscaping area to result in much actual water saved from extremely low water landscaping, so we are not that interested in these designs if they don't meet our primary landscaping

objectives.

7.4.1.5 To what level of sophistication will the irrigation controls be, beyond simple typical time clock functions and above ground sprinklers, to reduce water consumption?

Some. We desire climatic-compensating watering controls.

7.4.1.6 Provide the list of the LEED and/or CALGreen water efficiency features desired or required to be incorporated or those that are not to be considered.

The LEED scorecard is provided below as a reference for future consideration only.

WATER EFFICIENCY							
1		WEC1.1	D	Water Efficient Landscaping, 50% Reduction	MR	Open	
	1	WEC1.2	D	Water Efficient Landscaping, No Potable Water Use	MR	Open	
		WEC2	D	Innovative Wastewater Technologies	--	Closed	
1		WEC3.1	D	Water Use Reduction, 20% Reduction	GBS	Open	
1		WEC3.2	D	Water Use Reduction, 30% Reduction	GBS	Open	
3	1	1	Total Points for Water Efficiency				

Project shall NOT integrate LEED, only CAL Green compliance goals. The above table is for reference only.

7.5 Energy Efficiency

7.5.1.1 What level of overall building energy efficiency is required above code? (none, 10%, 20%, 30%, etc.).

The project goal is to possibly reduce design energy cost for electricity by as much as financially possible as compared to a comparable baseline building meeting CA Title 24.

7.5.1.2 Describe the desires for incorporating or not, all applicable low-cost / no cost efficiency features beyond code, evaluating moderate-cost efficiency features and state-of-the-art concepts. Define cost effective in relation to simple payback and life cycle cost and requirements for performing these analyses.

The design team shall comply with local codes and shall incorporate all applicable low-cost / no cost energy efficiency features beyond code or not specifically covered by code. The team shall seriously evaluate moderate-cost efficiency features beyond mandatory compliance that could be cost effective. The design team shall iteratively evaluate state-of-the-art concepts that appear to offer cost effective potential with a rough evaluation advancing to more thorough evaluation when promising, after consultation with the Owner. The design team will provide to the Owner lists of considered features whether incorporated or not.

Cost effective is defined as a simple payback of less than 5 years or a life cycle cost less than the baseline. A life cycle cost analysis (first cost, energy, operations, maintenance, replacement, productivity), is not necessary for measures with simple paybacks less than 5 years.

7.5.1.3 Specifics of HVAC energy efficiency are found in the HVAC section, lighting efficiency under Electrical and water heating under Plumbing.

7.5.1.4 List the optional **LEED Energy** or **CALGreen** elements desired.

Project shall NOT integrate **LEED**, only **CAL Green** compliance goals. The above table is for reference only.

ENERGY & ATMOSPHERE							
Y		EAp1	C	Fundamental Commissioning of Building Energy Systems	SBE	Open	
Y		EAp2	D	Minimum Energy Performance	IEI	Open	
Y		EAp3	D	Fundamental Refrigerant Management	IEI	Open	
1		EAc1.1	D	Optimize Energy Performance, 10.5% New / 3.5% Existing	IEI	Open	
1		EAc1.2	D	Optimize Energy Performance, 14% New / 7% Existing	IEI	Open	
1		EAc1.3	D	Optimize Energy Performance, 17.5% New / 10.5% Existing	IEI	Open	
1		EAc1.4	D	Optimize Energy Performance, 21% New / 14% Existing	IEI	Open	
1		EAc1.5	D	Optimize Energy Performance, 24.5% New / 17.5% Existing	IEI	Open	
1		EAc1.6	D	Optimize Energy Performance, 28% New / 21% Existing	IEI	Open	
1		EAc1.7	D	Optimize Energy Performance, 31.5% New / 24.5% Existing	IEI	Open	
1		EAc1.8	D	Optimize Energy Performance, 35% New / 28% Existing	IEI	Open	
1		EAc1.9	D	Optimize Energy Performance, 38.5% New / 31.5% Existing	IEI	Open	
	1	EAc1.10	D	Optimize Energy Performance, 42% New / 35% Existing	--	Open	
	1	EAc2.1	D	On Site Renewable Energy, 2.5%	--	Closed	
	1	EAc2.2	D	On Site Renewable Energy, 7.5%	--	Closed	
	1	EAc2.3	D	On Site Renewable Energy, 12.5%	--	Closed	
1		EAc3	C	Enhanced Commissioning	SBE	Open	
1		EAc4	D	Enhanced Refrigerant Management	IEI	Open	
1		EAc5	C	Measurement & Verification	IEI	Open	
1		EAc6	C	Green Power	TMT	Open	
13	4	Total Points for Energy & Atmosphere					

7.6 Materials and Resource Efficiency

7.6.1.1 Describe any sustainability material and resources goals. Provide the list of **CALGreen** applicable elements.

Project shall integrate interior materials that support very healthy, productive and safe indoor air quality. Construction and demolition waste recycling shall strive to achieve mandatory landfill diversion rate. Provide at least, at a minimum, 50% of non-hazardous construction and demolition debris to be recycled and/or salvaged.

Space allocation for recycling areas shall comply with Chapter 18, Part 3, Division 30 of the Public Resources Code. Chapter 18 (known as the California Solid Waste Reuse and Recycling Access Act of 1991). A waste management plan shall be submitted for approval to the enforcing agency.

		Most Likely	Possible	Not Probable			Responsible Party	Status	
MATERIALS & RESOURCES									
Y		MRp1	D		Storage & Collection of Recyclables		GBS/TVA	Open	
	1	MRC1.1	C		Building Reuse , Maintain 75% of Existing Walls, Floors and Roof		--	Closed	
	1	MRC1.2	C		Building Reuse , Maintain 95% of Existing Walls, Floors and Roof		--	Closed	
	1	MRC1.3	C		Building Reuse , Maintain 50% of Interior, Non-Structural Elements		--	Closed	
1		MRC2.1	C		Construction Waste Management , Divert 50%		Hoffman	Open	
1		MRC2.2	C		Construction Waste Management , Divert 75%		Hoffman	Open	
	1	MRC3.1	C		Materials Reuse , Specify 5%		--	Closed	
	1	MRC3.2	C		Materials Reuse , Specify 10%		--	Closed	
1		MRC4.1	C		Recycled Content , Specify 10%		Hoffman/TVA	Open	
	1	MRC4.2	C		Recycled Content , Specify 20%		Hoffman/TVA	Open	
1		MRC5.1	C		Regional Materials , 10% Extracted, Processed & Manufactured Regionally		Hoffman/TVA	Open	
	1	MRC5.2	C		Regional Materials , 20% Extracted, Processed & Manufactured Regionally		Hoffman/TVA	Open	
	1	MRC6	C		Rapidly Renewable Materials , Specify 2.5%		--	Closed	
	1	MRC7	C		Certified Wood		Hoffman/TVA	Open	
4	3	6	Total Points for Materials & Resources						

Project shall NOT integrate LEED, only CAL Green compliance goals. The above table is for reference only.

7.7 Indoor Environmental Quality

7.7.1.1 HVAC related IEQ goals and requirements are listed in the HVAC section.

7.7.1.2 List any indoor environmental quality goals or elements from LEED or CALGreen.

Some elements are listed below. The LEED scorecard is only provided for reference and possible future goals. CAL Green must be satisfied, however.

High efficiency HVAC equipment, lighting, and hot water systems are used. Low water-use plumbing fixtures are specified for both flush and flow fixtures to reduce the amount of water usage. The building's infrastructure includes a passive lighting design in Major B using extensive skylights throughout in addition to the full retail lighting system. This will allow the tenant to utilize day-lighting controls to alleviate their lighting power loads.

(CEC) California Energy Commission adopts regulations to establish minimum levels of energy efficiency that a conditioned structure must meet or exceed.

Performance is based on a Prescriptive Method or Performance Method (computer analysis) per filled out forms on drawings.

7.7.2 Lighting and visual quality requirements.

These are listed under the Electrical section.

INDOOR ENVIRONMENTAL QUALITY							
Y		EQp1	D	Minimum IAQ Performance	IEI	Open	
Y		EQp2	D	Environmental Tobacco Smoke (ETS) Control	TMT	Open	
	1	EQc1	D	Outside Air Delivery Monitoring	--	Closed	
	1	EQc2	D	Increased Ventilation	--	Closed	
1		EQc3.1:	C	Construction IAQ Management Plan, During Construction	Hoffman	Open	
1		EQc3.2:	C	Construction IAQ Management Plan, After Constr./Before Occ.	Hoffman	Open	
1		EQc4.1	C	Low-Emitting Materials, Adhesives and Sealants	Hoffman/TVA	Open	
1		EQc4.2	C	Low-Emitting Materials, Paints and Coatings	Hoffman/TVA	Open	
1		EQc4.3	C	Low-Emitting Materials, Carpet	Hoffman/TVA	Open	
1		EQc4.4	C	Low-Emitting Materials, Composite Wood & Agri-fiber products	Hoffman/TVA	Open	
1		EQc5	D	Indoor Chemical & Pollutant Source Control	IEI	Open	
1		EQc6.1	D	Controllability of Systems: Lighting	TMT	Open	
1		EQc6.2	D	Controllability of Systems: Thermal comfort	TVA	Open	
1		EQc7.1	D	Thermal Comfort, Design	IEI	Open	
1		EQc7.2	D	Thermal Comfort Verification, Verification	TMT	Open	
1		EQc8.1	D	Daylight and Views, Daylight 75% of Spaces	GBS	Open	
1		EQc8.2	D	Daylight and Views, View for 90% of Spaces	GBS	Open	
13	2	Total Points for Indoor Environmental Quality					

The above table is inserted as a possible guide for “future” consideration only, and not a part of the construction document goals. All current development will meet or exceed CAL Green only (not LEED).

7.7.3 Acoustics

7.7.3.1 What is the desired level of acoustical performance and control (background noise levels) of each of the occupancy types (standard, above standard, exceptional)? List any spaces with special acoustical requirements. Give NC targets for each.

General goal: Above standard. Meet local code requirements and industry standards at a minimum.
Office / Medical / Dental general: Standard, NC 35-40
Office executive (RE – Accounting): Above Standard, NC 30-35
Day Care: Above Standard, NC 30-33 in sleeping areas, NC 30-35 in other rooms, NC 30-35 in primary and dining rooms (not kitchens and bathrooms, or utility rooms), and NC 35-40 in corridors.
Public Areas: Standard, NC 35-45
Retail: Standard, 35-40
Food establishments: Standard, 35-45

7.7.3.2 Are there any areas where a special level of acoustical separation is desired to adjacent rooms, spaces or from outdoors? (e.g., between executive offices, strategic planning rooms, recreation rooms, rest areas, retail, mechanical rooms, etc.) Minimally, indicate these special acoustical separations to be above standard or exceptional. Ideally, provide a target separation (wall, ceiling, floor) Sound Transmission Class (STC).

Between tenant spaces: Walls. Minimum Retail rated, Sound

*Transmission Class (STC) for walls of 55, and 55 for roofs.
Higher performance is expected with the designed systems.
Floors.*

8. Building Envelope

8.1 Overall Envelope Criteria

- 8.1.1.1 Describe the overall envelop design criteria and any special concerns that exist. List any special features desired or required to be considered or a part of this project. (e.g., rain penetration, sun and dryness, stack effects, envelope air leakage, façade mockup requirements, insitu water or air leakage testing, etc.)

The building envelope shall be designed to meet the wet City climate without water leaks of any kind during normal and extreme rainfall and winds. The design shall include provisions to weep to the outside any moisture that penetrates the outer façade without causing degradation to the building elements. Rain screens are required behind outer surfaces that are moisture permeable, like masonry. Water leakage integrity of the outer surface shall rely on mandatory 2013 CEC Title 24 and CAL Green compliance standards. The design will result in a compliant air leakage rate for this type of structure and will minimize and mitigate impacts of the stack effect.

All horizontal sills (if elevated above the floor) will slope down to the outside. Wall assembly, flashing and caulking details will be clearly shown in the drawings for each configuration, type of joint, attachment and connection. The specifications will require a mock-up or performance testing reports of each major glazing type and adjacent building elements for air and water penetration using ASTM standard field or laboratory tests.

8.2 Additional Envelope Criteria

- 8.2.1.1 Are there any envelope (roofing, façade, and fenestration) products or techniques that are not acceptable, including glazing tinting, etc.?

No reflective glass. Glass shall not appear too “green” from interior.

- 8.2.1.2 Describe the basic building envelope requirements and concerns (roof, exterior wall, fenestration, daylighting, subgrade elements) in broad terms. Include issues such as aesthetics, context, durability, maintainability, sustainability, energy efficiency.

Transparency is important to this owner. Promote daylighting while avoiding significant heat loads that will overburden cooling systems. Highly reflective roofing is desired to comply with CAL Green cool roof requirements. Low maintenance materials should be specified. US-

based materials shall be preferred.

- 8.2.1.3 What are the fenestration requirements (natural daylighting for perimeter or deeper spaces, elimination of daylight, access to daylight views, solar orientation, internal uses, entrance location requirements based on site specific considerations, functional needs, aesthetics, climate)?

No special treatment necessary.

In general, the fenestration should respond to the region's temperate climate.

- 8.2.1.4 What are the roof shape and material considerations (climatic, aesthetic, traffic bearing, equipment support, cost, local expertise in materials considerations, etc.)?

The roof shape should pronounce the building as an icon. The building will be strategically lit at night to have the appearance of a lantern. Energy Star rated, low maintenance roof membrane. Mechanical equipment will be screened to be invisible.

The lighting of certain portions of the building will be accomplished using low-energy LED lights which will uniformly light translucent glass internally from behind to achieve a glowing, lantern effect while minimizing night-time light pollution.

- 8.2.1.5 What are the thermal performance criteria for the building envelope (energy code minimums, super-insulated, energy payback, green building components, occupant comfort)?

The building envelope thermal performance will exceed code minimums by utilizing thermally broken and insulated low U-value glass, that minimize both unwanted exterior solar heat gain and interior heat and cooling losses.

- 8.2.1.6 What are the durability requirements (first cost considerations vs. life cycle cost, long-term monument vs. short-term speculative building, sustainability, future additions and/or transformations, flexibility for reuse)?

The building will be held by the owner. Life cycle costs for the envelope elements and assemblies will be evaluated to inform material and design strategy decision making. The goal is long-term value.

- 8.2.1.7 What are the maintenance requirements (minimum maintenance, availability of well-staffed maintenance department, most maintenance outsourced, sophistication of maintenance department, availability of sustainable products for maintenance tasks, costs)?

The Retail Center will be maintained by in house fully accredited and licensed engineering and maintenance staff.

- 8.2.1.8 What are, if any, constraints on building envelope performance from future/proposed development and/or changes to adjacent lots/properties?

None

9. Plumbing Systems

9.1 Water Efficiency

- 9.1.1.1 Refer to the Water Efficiency section under Sustainability for details of the water efficiency objectives of this project.

9.2 Fixture Controls

- 9.2.1.1 Are auto-flushing and on/off controls desired on urinals, lavatories, toilets?

Yes

- 9.2.1.2 Are waterless urinals a consideration? Where?

Not at this time, but 1 pint urinals are desired.

9.3 Energy Efficiency

- 9.3.1.1 The water heating system energy design is desired to be: standard code, somewhat more efficient than code, much more efficient than code?

Somewhat more efficient than code requires. In order to properly size each water heater, the average tap water temperature locally available is necessary. Also, the thermal efficiency for gas appliances is assumed to be 75%. The BTU input is equal to GPH x temp. rise x 8.33 lb. per gallon of water divided by the thermal efficiency.

Example: 54 gph x 60 degrees x 8.33 lb. / 0.75 = 35,985 BTU.

- 9.3.1.2 Are there specific system types that shall be incorporated or that are not to be considered (e.g., point of use heaters, electric heaters, etc.)?

Yes. The hot water source for new buildings heating requirements will be supplied from the hot water heater located in the janitor's closet. There will be a hot circulating pump.

- 1. Water heater shall be fuel-gas tank type.*
- 2. Meets ASHRAE Standard for energy efficiencies.*
- 3. Hot water piping shall be insulated.*

10. Fire Alarm

- 10.1.1.1 List the specific brand and/or model of fire alarm system required, if any.
No specific type required.
- 10.1.1.2 List any special features desired or required of the fire alarm system.
Fully addressable system required. Code compliant minimum system with additional features mentioned below.
- 10.1.1.3 Describe where the fire alarm signal is to be sent to off site.
Alerts or troubles will remain in the fire alarm panel. Alarms will be sent to the BAS as a general alarm and to the municipal fire department.
- 10.1.1.4 Is the FA system to have addressable and monitored fire smoke dampers (ones that can be commanded open or closed from the fire alarm panel)?
Yes.
- 10.1.1.5 Are the fire smoke dampers to have end switches that positively confirm closed and open positions or is the commanded position notification acceptable?
End switches are required.

11. Data and Communications Systems

- 11.1.1.1 Describe the data requirements in the building.
Data requirements for building are currently under review by the electrical designer and owner. However, scope of work at this time includes horizontal cabling for tenant spaces (phone and CATV), backbone cabling to each office space and each of two major retail tenant spaces, and other (house) cabling needs. This includes copper, cable TV and fiber optic for backbone, and copper UTP and CATV for horizontal cabling.
- 11.1.1.2 Describe the needs for future expansions.
TBD.
- 11.1.1.3 Will special backbone, conduit and cabling be required to unfinished areas so offer those tenants adequate data and communications?
Conduit shall be provided through closed-in in accessible spaces
- 11.1.1.4 Describe the wireless internet systems desired for the building.

TBD

- 11.1.1.5 Describe the communication systems desired for the building.

TBD

- 11.1.1.6 Will the property owner/manager be reselling phone and internet services or will those services be provided directly to the tenant/resident by a service provider?

TBD

- 11.1.1.7 Are both CATV and Satellite availability required?

TBD

- 11.1.1.8 Are there any requirements for A/V system (tenant Space Theater) options or pathways in the food service units?

TBD

- 11.1.1.9 Will wireless access to the internet be provided for the residential areas, or will this be by the tenants? For the office areas? For the retail areas?

TBD

- 11.1.1.10 Describe any tie-in between the data and communication systems and the security system or building automation system.

TBD

12. Security and Access

- 12.1.1.1 What are the securities concerns for this facility?

Controlling access to office and shops during the day and after hours. 24/7 monitoring of CCTV system.

- 12.1.1.2 List the specific brand and/or model of security system required, if any.

No specific type required.

- 12.1.1.3 What access control must this facility accommodate?

Office and retail should be securable during the day and/or after hours, depending on needs of tenants. Entry into the buildings themselves should also be controlled, ideally by the use of a proximity card access controls system as an option.

- 12.1.1.4 What areas of the facility will require controlled access?

All spaces including office, food service, retail, and mechanical areas. All areas housing critical building systems will also need to be secured. Delivery areas should also be securable.

- 12.1.1.5 Describe the desired security system features (e.g., card reader, fingerprint, retina scanner types, length of image storage capacity, remote access capabilities and backup features, user programmability, reporting functions, battery backup duration, etc.).

HD CCTV DVR systems; programmable magnetic proximity card reader system for individual door access; steel rolling door to secure loading dock and/or garage entry; two way communication "distress" devices strategically placed throughout with direct communication to 24/7 on duty Security Company.

- 12.1.1.6 Describe any required interlocks between the security system and the building automation system and HVAC.

None.

---END of OPR-

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**CALGreen Compliance Form- Owner's Project Requirements
(OPR)**

□City of Rancho Mirage

City Project No. CP15-315

Rancho Mirage Observatory□

CALGreen
Std. BSC-5.4-5
10-08-10

2013 Guide Supplement
Including changes effective July 1, 2012

REFERENCED STANDARDS

CALGreen Compliance Form-Owner's Project Requirements (OPR) 15-11	CALGreen Std. BSC-5.4-5.1.7-
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INCORPORATE THIS FORM IN THE PLANS

Project Address: Observatory Permit Number: _____

ITEM #	OPR ITEMS	SECTION-NUMBER IN OPR
PROJECT PROGRAM		
1	General building information (size, stories, construction type, occupancy type and number)	2.1.1.1 – 2.1.1.6
2	Intended uses and schedules	2.1.1.3
3	Future expandability and flexibility of spaces	2.1.1.8
4	Quality and/or durability of materials and desired building lifespan	2.1.1.5 / 2.1.1.7
5	Budget or operation constraints	2.1.1.13
ENVIRONMENTAL AND SUSTAINABILITY GOALS		
6	Level of compliance with the <i>California Green Building Standards Code</i> : Mandatory, Tier 1, or Tier 2	2.1.1.15
7	Specific environmental or sustainability goals (e.g., water efficiency, water reuse, CO ₂ monitoring, xeriscaping, etc.)	2.1.1.15
ENERGY EFFICIENCY GOALS		
8	Overall efficiency of building: meet <i>California Energy Code</i> or exceed by (%)	2.1.1.15
9	Lighting system efficiency: meet <i>California Energy Code</i> or exceed by (%)	5.5.1.1
10	HVAC equipment efficiency and characteristics	2.1.1.14 / 4.6.1.1
11	Other measures affecting energy efficiency desired by owner (e.g., Building orientation, shading, daylighting, natural ventilation, renewable power, etc.)	2.1.1.15 / 2.1.1.18
INDOOR ENVIRONMENTAL QUALITY REQUIREMENTS		
12	Lighting	5.7.1.1
13	Temperature and Humidity	4.16.1.1
14	Acoustics	7.7.3
15	Air quality, ventilation, and filtration	4.4.1.2 / 4.2.1.7
16	Desired adjustability of system controls	4.3.1.3
17	Accommodations for after-hours use	4.1.1.2
18	Other owner requirements (e.g., natural ventilation, daylight, views, etc.)	8.1.1.1
EQUIPMENT AND SYSTEMS EXPECTATIONS		
19	Level of quality, reliability, equipment type, flexibility, maintenance, and complexity desired	4.1.1.6
20	Specific efficiency targets, desired technologies, or preferred manufacturers for building systems, acoustics and vibration	4.2.1.1
21	Degree of system integration, automation, and functionality for controls (i.e., load shedding, demand response, energy management)	4.2.1.2
BUILDING OCCUPANT AND O&M PERSONNEL EXPECTATIONS		
22	Description of how the building will be operated and by whom	2.1.1.11

23	Level of training and orientation required to understand, operate and use the building systems for building operation and maintenance staff, as well as occupants	3.2.1.1
24	Building operation and maintenance staff location and capabilities	3.2.1.1
COMMISSIONING AGENT INFORMATION		
25	Name of Commissioning Agency: SEE DIRECTORY	
26	Address of Agency:	
27	Contact person(s) Name(s):	

REFERENCED STANDARDS

OWNER/OWNER REPRESENTATIVE ACKNOWLEDGEMENT

Owner's Project Requirements (OPR). The expectations and requirements of the building appropriate to its phase shall be documented before the design phase of the project begins.
The OPR includes the elements listed above and have been approved by the Owner or Owner Representative.

Name: _____ Owner Owner Representative

□City of Rancho Mirage

City Project No. CP15-315

Rancho Mirage Observatory□

Company Name (if applicable): _____

Signature: _____ Date: _____

CAL Green Construction Waste Management

PART 1 GENERAL

1.1 This Section describes the Purpose of Construction and Demolition Waste Management Plan and Diversion Goals:

1.2 Construction and demolition generate enormous quantities of solid waste. EPA estimates that 136 million tons of such debris was generated in 1996, 57% of it from non-residential sources. Commercial construction generates between 2 and 2.5 pounds of solid waste per square foot, and the majority of this waste could be recycled.

A. Submit the project goals with respect to the percentage (%) of diverted waste that is expected from the project to the project Architect and Commissioner for compliance.

B. Include ATTACHMENT 8 in this project manual as the final submittal.

1.3 Construction and Demolition Waste Management Personnel:

*Construction Waste Coordinator:
Name of person in charge of waste hauling.
Other:*

1.4 Communication Plan:

A. Include, as a part of the compliant submittal package, the following as relevant to the project:

1. Distribution of Waste Management Plan:
 - a. Identify construction methods employed to reduce waste.
 - b. Specify if materials will be sorted on-site or mixed for a transportation to a diversion facility.
 - c. Identify the materials to be diverted.
2. Pre-job meeting with key subcontractors
3. Below is for the general contractor’s information, a sample of a communication plan:

“The GC will coordinate with all suppliers and sub-contractors to ensure that the least amount of waste is produced. Each supplier or trade will make a good faith effort to reduce the amount of waste generated and to recycle in conformance with the following construction and demolition waste management plan. The subcontractors will need to follow the recommended handling procedures and provide documentation to verify material reuse, recycling and disposal.

- *Waste Management Plan will be distributed to all subcontractors.*

- *The General Contractor will hold a pre-job meeting with subcontractors to ensure recycling and waste management procedures are clear.*
- *Subcontractors will be required to make sure their crews comply with the Waste Management Plan.*
- *All recycling containers will be clearly labeled.”*

PART 2 PLAN COMPONENTS

2.1 Analysis of proposed construction and demolition waste generation:

each A. Analysis should include types of material and estimated quantity of material (in tons or cubic yards).

2.2 Landfill Options:

- A. Estimate cost of disposing all project waste through transfer station(s)/landfill(s). Include the stations names and location (city, state). Provide tipping fee cost and estimates of transportation and other relevant fees/costs.
- B. Alternative: Identify opportunities to recycle materials during the course of the project. Provide a list of materials that have been recognized as recyclable. The list should include the following materials, at a minimum:

- 1) Concrete
- 2) Asphalt
- 3) Bricks
- 4) Concrete Masonry Units (CMU)
- 5) Land-clearing debris
- 6) Clean dimensional lumber
- 7) Plywood, OSB, and particle board
- 8) Cardboard
- 9) Paper
- 10) Metals
- 11) Gypsum Wallboard
- 12) Carpet
- 13) Paint
- 14) Plastic
- 15) Glass
- 16) Rigid Foam Insulation
- 17) Beverage Containers

C. Identify opportunities to salvage and reuse materials during the course of the project. Provide a list of materials that have been recognized as

salvageable and reusable. Special care should be taken when removing salvageable items to ensure they are maintained in a reusable state. The list should include the following materials, at a minimum:

- 1) Fixtures
- 2) Fittings
- 3) Hardware
- 4) Panel Products (e.g. plywood, particle board)
- 5) Dimensional lumber
- 6) Trim
- 7) Case work
- 8) Steel
- 9) Brick

- D. Provide a list of items that may/can be donated if applicable as well since charitable donations are also considered a diversions from the landfill.
- E. Material Handling Procedures: Provide a description of the material handling procedures, including how the materials will be protected from contamination and the procedure/means to ensure the above materials are consistent with the sorting/recycling facilities requirements.

2.3 Transportation:

- A. Provide a description of the transportation means used to haul and deliver the materials to the final destination.
- B. Include information that describes if the materials are site separated, self-hauled to designated centers or whether the materials are commingled and sorted at sorting facility.

END OF DOCUMENT

CAL Green Construction Indoor Air Quality Management Plan

PART 1 GENERAL

1.1 SMACNA Requirements: Refer to ATTACMENT 9 in the project manual

- A. Post on construction site (IAQ Management Plan – ATTACMENT 9)
- B. Indoor Air Quality Management Personnel: General Contractor shall submit the following information (project team members) to the project architect and commissioner.

Indoor Air Quality (IAQ) Coordinator:
IAQ assistant:
Mechanical subcontractor IAQ Coordinator:

PART 2 PROJECT SUMMARY: PROJECT DETAILS

2.1 Indoor Air Quality Control Measures:

- A. The project team will implement the following IAQ control measures during construction, as recommended in the SMACNA IAQ Guidelines for Occupied Building under Construction, CAL Green Chapter 3:

B. PART 2 HVAC Protection

- 1. All HVAC equipment must be protected from collecting dust and odors.
- 2. Specific HVAC protection measures generally apply to either the return side, central filtration or the supply side.

2.2 Return Side

- A. When possible the entire system will be shut down during heavy construction or demolition.
- B. The HVAC system will be isolated from the surrounding environment as much as possible (e.g., all tiles in place for a ceiling plenum, duct and air handler leaks repaired) to prevent induction of pollutants.

- C. All return system openings in (or immediately adjacent to) the construction area will be sealed with plastic.
- D. When the system must remain operational during construction, MERV 8 filters will be added on all return air grills. All filters will receive frequent maintenance and be replaced at the end of the project.
- E. When the general system must remain operational, the heaviest work areas will be *dampened* off or otherwise blocked if temporary imbalance of the return air system does not create a greater problem.
- F. The mechanical room will not be used to store construction or waste materials.
- G. Photographs of typical methods and procedures will be taken periodically by the General Contractor.

2.3 Central Filtration

- Where major dust loading is expected to impact operating HVAC systems, considerations will be given to upgrading filter efficiency.

2.4 Supply Side

- A. When the system is off for the duration of the construction diffusers and window units will be sealed in plastic for further protection. Ducts, diffusers and window units will be inspected and cleaned upon completion of the work.
- B. Ducts will be inspected during renovation and cleaned if pre-existing dust is found.

PART 3 SOURCE CONTROL

- 3.1 Prefabricated insulated duct work will be protected against moisture during delivery to the job site. Duct work will be stored inside in a dry, clean environment.
- 3.2 Motor vehicles will be restricted to loading areas. Truck idling will be prohibited near air intake locations.
- 3.3 Electric or natural gas alternatives to gasoline and diesel equipment will be used when possible and practical. Equipment not in use will be turned off.

3.4 The materials and products used will comply with LEEDv2009 Indoor Environmental Quality requirements.

PART 4 PATHWAY INTERRUPTION

4.1 Dust curtains or plastic area sealing will be used to prevent dust from migrating to other areas when applicable.

4.2 Pressure differentials will be used to prevent the contamination of clean areas.

4.3 Pollutant sources will be kept as far away from supply ducts and worker occupied areas.

PART 5 HOUSEKEEPING

5.1 General housekeeping and dust suppression will use wetting agents or sweeping compounds.

5.2 Efficient dust collection, including damp rag, wet mop, or high efficiency vacuums with a particulate filters or wet scrubbers will be used.

5.3 All surfaces including higher ledges, behind furniture and inside mechanical equipment) will be kept clean.

5.4 Spill or excess applications of products containing solvents will be taken care of as soon as possible.

5.5 Accumulated water will be removed and work areas will be kept as dry as possible. Dehumidifiers will be used if necessary.

5.6 Porous materials, such as insulation and ceiling tile, will be protected from exposure to moisture.

5.7 All coils, air filters, fans and ductwork will remain clean during installation and will be cleaned prior to performing the testing, adjusting and balancing of the systems.

PART 6 SCHEDULING

6.1 Scheduling will be coordinated to minimize the impact on indoor air quality.

6.2 New filters (MERV 13 filters if LEED credit EQc5 is being pursued) will be installed prior to building flush out and replaced after the flush out, prior to occupancy.

6.3 The move in of fixtures, furnishings and equipment will take place prior to the flush out period.

6.4 Only approved construction activities will take place during the flush out period.

END OF DOCUMENT

CERTIFICATE OF INSTALLATION - USER INSTRUCTIONS NRCV- MCH- 04- H Duct Leakage

Diagnostic Test - MCH- 04e

1 of 1

A. System Information

1. *HVAC System Identification or Name:* Same data given on MCH- 01; provides an identification name or tag name that uniquely identifies the duct system. If there is a mechanical plan for the system, the tag name may be given on the plans.
2. *HVAC System Location or Area Served:* Same data given on MCH- 01; provides a brief description of the area served by the duct system (e.g. upstairs; downstairs).
3. *Verified Low Leakage Air- handling Unit (VLLAHU) Credit:* Same data given on PRF- 01; Details whether or not VLLAHU is required per PRF- 01.
4. *Duct System Compliance Category:* Choose from Completely New, Complete Replacement, or Alteration.
 - a. New: For new buildings with a new HVAC system or replacement of at least 75 percent of the duct system and up to 25 percent consisting of reused parts from the existing duct system (i.e. registers, grilles, boots, air handler, coil, plenums, duct material).
 - b. Alteration: For HVAC change-outs or when the air handler, condensing unit of a split system, or cooling coil or any amount of duct is added to an existing system but does not constitute a new duct system.
 - c. Alteration using Smoke Test: For alterations that are unable to pass the leakage test, a smoke test is allowed to confirm that all accessible leaks have been sealed.

B. Duct Leakage Diagnostic Test - MCH- 04e – Sealing All Accessible Leaks Using Smoke Test

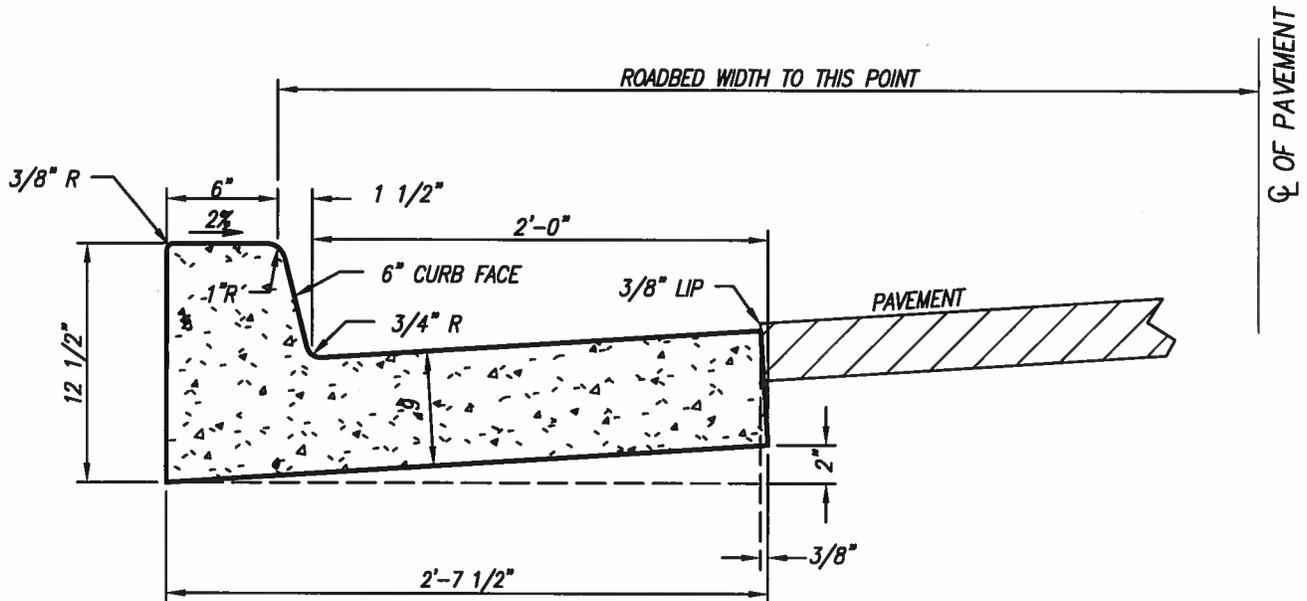
1. *Condenser Nominal Cooling Capacity (ton):* Enter the condenser nominal cooling capacity, refer to the manufacturer documentation.
2. *Heating Capacity (kBtu/h):* Enter the system heating capacity, refer to the manufacturer documentation.
3. *Leakage Factor:* Depending on answer to A04 the leakage factor will be either .06 or .15.
4. *Air- Handling Unit Airflow (AHUAirflow) Determination Method:* User will select from the following options:
 - a. Cooling System Method: For systems with cooling, this selection must be made, and the nominal air handler airflow shall be 400 CFM per nominal ton of condensing unit cooling capacity (See Section NA2.1.4.1 of the 2013 Nonresidential Appendices).
 - b. Heating System Method: For heating only systems the nominal air handler airflow shall be 21.7 CFM per kBtu/hr of rated heating output capacity (See Section NA2.1.4.1 of the 2013 Nonresidential Appendices)..
5. *Calculated Target Allowable Duct Leakage Rate (cfm):* This value will be automatically populated depending on values in B04.
6. *Actual Duct Leakage Rate from Leakage Test Measurement (cfm):* User will input this value from actual measurements from leakage test.

7. *Compliance Statement:* If Actual Duct Leakage Rate from leakage test (B06) is less than or equal to Calculated Target Allowable Duct Leakage Rate (B05), "System passes leakage test" will automatically populate. If measured leakage rate is greater than target allowable leakage rate then display message: "System passes using smoke test of an altered HVAC system in an existing building"
- No visible smoke exits the accessible portions of the duct system.
 - Smoke is only emanating from air- handling unit (AHU) cabinet and non-accessible portions of the duct system.

Note – Accessible is defined as having access thereto, but which first may require removal or opening of access panels, doors, or moving similar obstructions. If access to the ducts requires an object to be demolished or deconstructed then sealing of those ducts is not required.

APPENDIX
STANDARD PLANS USED FOR THE PROJECT

City of Rancho Mirage Standards 200, 203, 206, 602, 604

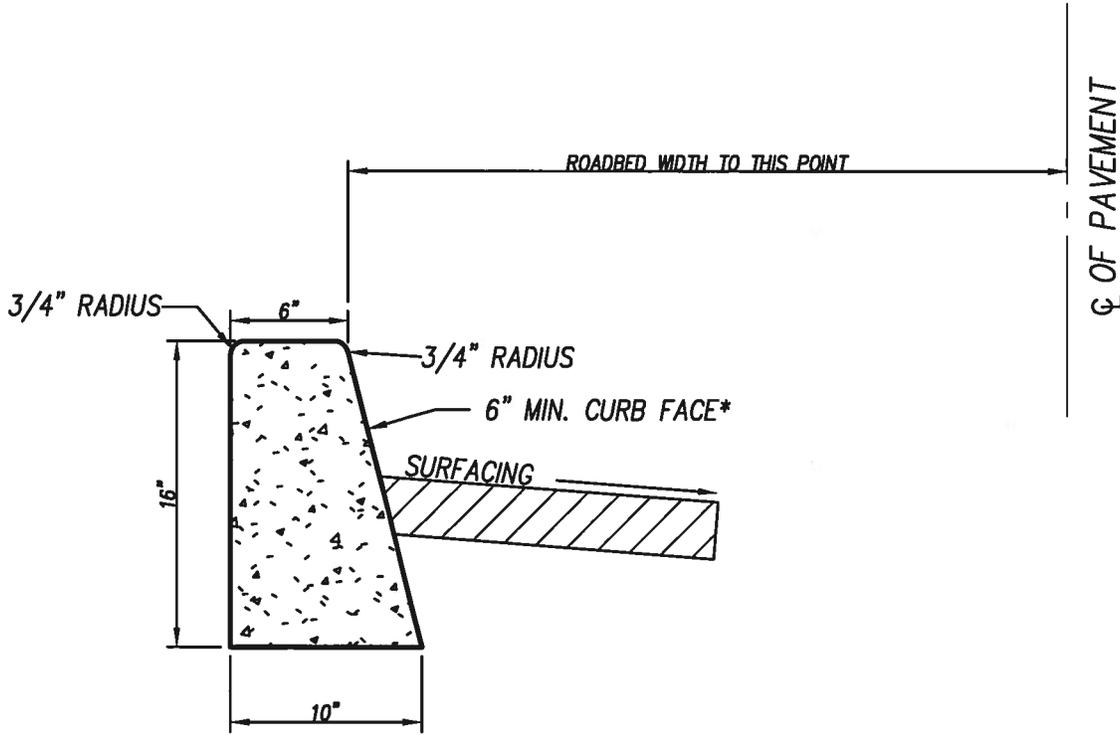


CLASS 560-C-3250 CONCRETE (NO FLY ASH) *
 1.601 CU. FT./L.F.
 1 CU. YD. = 16.86 L.F.

MINIMUM PERMISSIBLE GRADE 0.50%
 MINIMUM SUBGRADE COMPACTION 95% RELATIVE TO MAXIMUM
 MAX. GRADE BREAK ON ROADWAYS SHALL NOT EXCEED 0.50%
 ALL GUTTER SHALL BE "FLOW TESTED" PRIOR TO PAVING
 SEE STANDARD 206 FOR JOINT DETAILS

* USE CONCRETE CURING COMPOUND, ASTM C309/AASHTO M148, TYPE 2,
 CLASS A OR B, WITH WHITE PIGMENT. AFTER CURING, COMPOUND SHALL
 BE "POWER WASHED" OFF CURB TOP AND FACE BEFORE ANY CURB PAINTING

CITY OF RANCHO MIRAGE		STANDARD DETAIL 200
REVISIONS	TYPE "A" (6") CURB & GUTTER	
12/17/2001		
* 7/5/2012	<i>[Signature]</i> 7/12/12	
	APPROVED BY: CITY ENGINEER DATE	

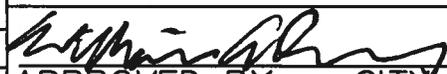


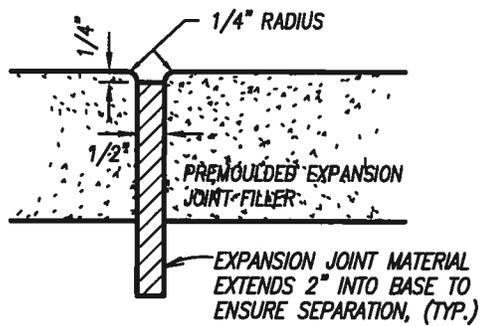
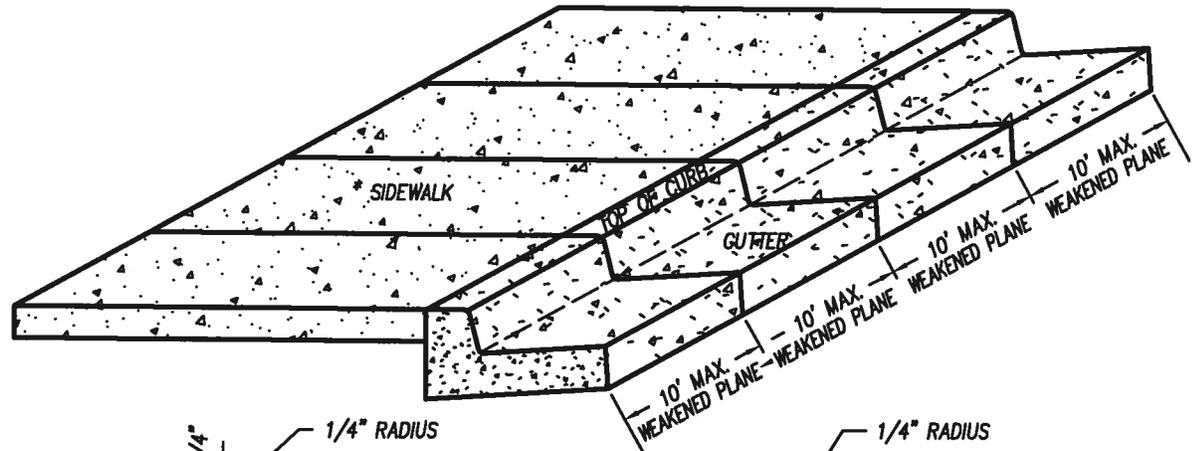
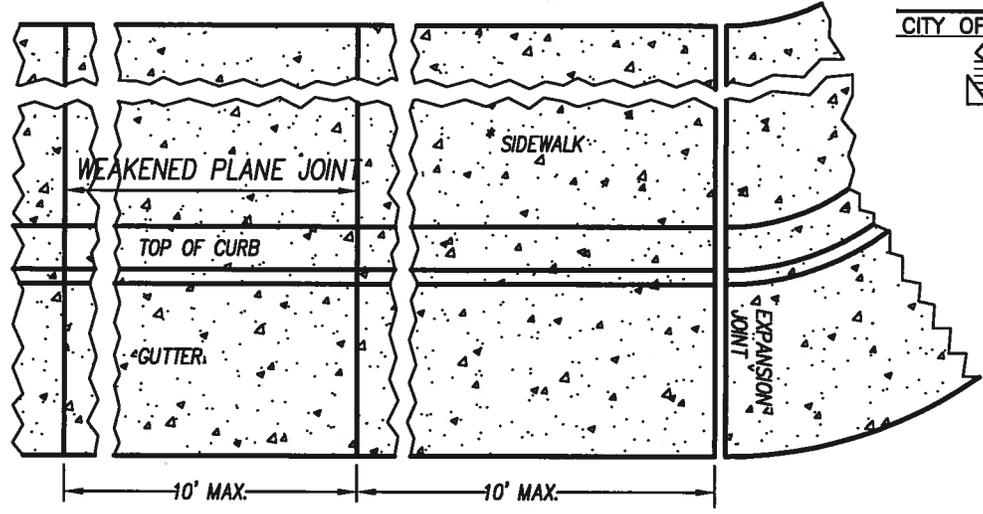
CLASS 560-C-3250 CONCRETE (NO FLY ASH)
 .888 CU. FT./L.F.
 1 CU. YD. = 30.41 L.F.

MINIMUM PERMISSIBLE GRADE 0.50%
 MINIMUM SUBGRADE COMPACTION 95% RELATIVE TO MAXIMUM
 MAX. GRADE BREAK ON ROADWAYS SHALL NOT EXCEED 0.50%
 SEE STANDARD 206 FOR JOINT DETAILS

* USE CONCRETE CURING COMPOUND, ASTM C309/AASHTO M148, TYPE 2,
 CLASS A OR B, WITH WHITE PIGMENT. AFTER CURING, COMPOUND SHALL
 BE "POWER WASHED" OFF CURB TOP AND FACE BEFORE ANY CURB PAINTING

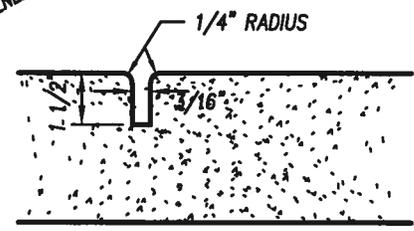
8" CURB FACE SHALL BE USED ON ALL ROADWAY MEDIAN CURBS

CITY OF RANCHO MIRAGE		STANDARD DETAIL 203
REVISIONS	TYPE "D" (6" OR 8") CURB	
12/17/2001		
* 7/5/2012		
APPROVED BY:  7/12/12		
CITY ENGINEER		DATE



EXPANSION JOINT

- EXPANSION JOINTS TO BE INSTALLED AT ALL B.C., E.C.,
- * CURB RETURNS, DRIVEWAYS, CATCH BASINS, OR
- * SIMILAR STRUCTURES, IN CURBS AND SIDEWALKS
- * SIDEWALKS SHALL ALSO GET EXPANSION JOINTS @ 40' O.C.



WEAKENED PLANE JOINT

10' INTERVAL BETWEEN TRANSVERSE JOINTS MAY BE VARIED TO ALLOW MATCHING OF JOINTS IN ADJACENT EXISTING IMPROVEMENTS.

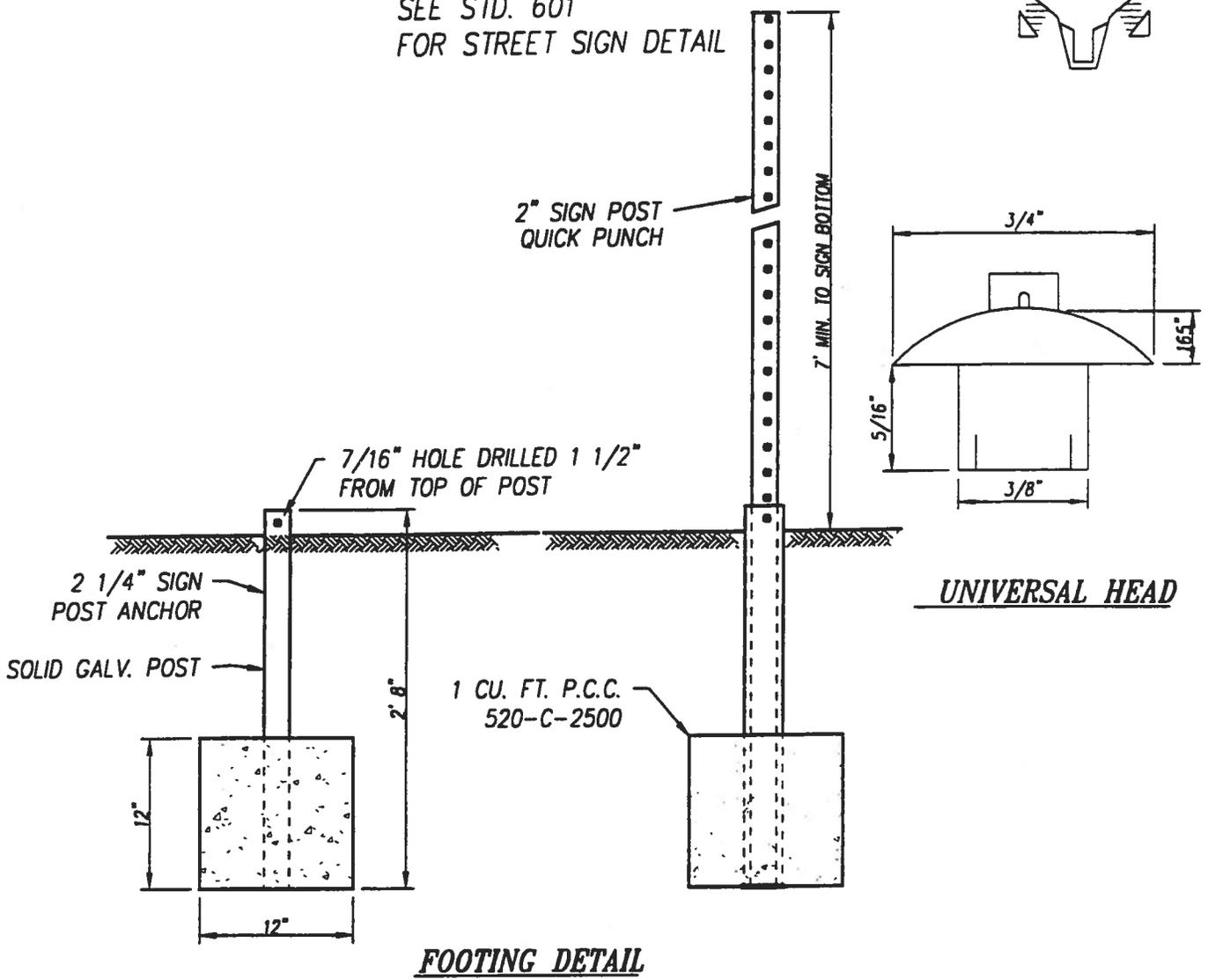
NOTE:

FOR MACHINE EXTRUDED CURBING IT IS REQUIRED TO "SAWCUT" JOINTS INTO THE CONCRETE WHEN IT HAS SET ENOUGH TO NOT FRACTURE. DO PARTIAL CUTS AT 10' INTERVALS, THROUGH THE CURB AND 1.5" INTO THE GUTTER FOR WEAKENED PLANE JOINTS. FOR EXPANSION JOINTS IN EXTRUDED CURBING, SAWCUT COMPLETELY AND INSERT JOINT MATERIAL AS DESCRIBED ABOVE.

CITY OF RANCHO MIRAGE		STANDARD DETAIL 206
REVISIONS	CURB, GUTTER & SIDEWALK JOINTS	
11/27/2002		
* 7/5/2012		
APPROVED BY: CITY ENGINEER DATE		



SEE STD. 601
FOR STREET SIGN DETAIL



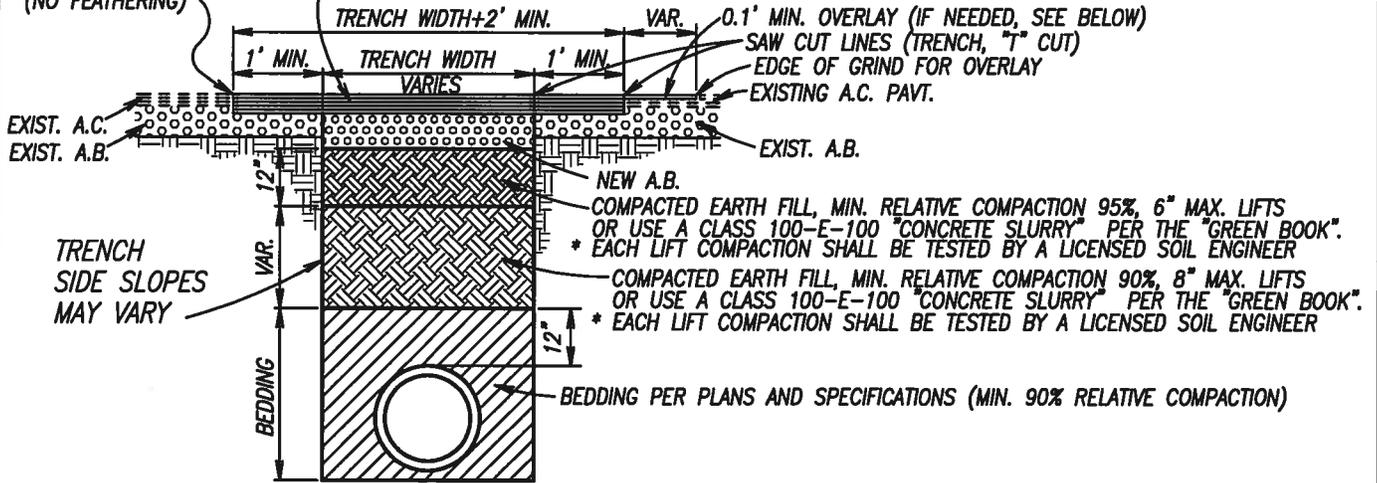
1. Place sign post anchor into ground approximately 2'-6" depending on local soil conditions. Drill one 7-16" hole approximately 1 1/2" from the top of the anchor post.
2. Insert sign post and rivet in place with two 3/8" Universal Head Drive Rivets, one placed facing traffic and one perpendicular to traffic.
3. All posts to be electrostatically powder coated with City approved brown coating.

CITY OF RANCHO MIRAGE		STANDARD DETAIL 602
REVISIONS	SIGN POST INSTALLATION	
APPROVED BY: <i>William G. ...</i> CITY ENGINEER DATE: <i>5/31/01</i>		



RESIDENTIAL STREETS: 4" A.C. OVER 4" A.B.
ALL OTHER STREETS: 5" A.C. OVER 10" A.B.

JOIN EXISTING A.C. PAVT. WITH SMOOTH BUTT JOINT (NO FEATHERING)



"T-TRENCH" DETAIL
NOT TO SCALE

TRANSVERSE TRENCH CUTS

- 0" TO 12" WIDE - REPAIR TRENCH WIDTH ONLY (NO "T-TRENCH")
- 12" TO 24" WIDE - REPAIR TRENCH WIDTH PLUS ADDITIONAL 1' "T" ON BOTH SIDES
- >24" WIDE - REPAIR TRENCH WIDTH PLUS ADDITIONAL 1' "T" ON BOTH SIDES PLUS GRIND/OVERLAY 0.1' MIN. THICK FOR AN ADDITIONAL 3' ON BOTH SIDES.

LONGITUDINAL TRENCH CUTS IN DRIVING LANES

- 0" TO 12" WIDE - REPAIR TRENCH WIDTH ONLY (NO "T-TRENCH") PLUS 0.1 GRIND AND OVERLAY FROM FROM LANE LINE TO LANE LINE
- 12" TO 24" WIDE - REPAIR TRENCH WIDTH PLUS ADDITIONAL 1' "T" ON BOTH SIDES PLUS 0.1' GRIND/OVERLAY FROM LANE LINE TO LANE LINE
- >24" WIDE - REPAIR TRENCH WIDTH PLUS ADDITIONAL 1' "T" ON BOTH SIDES PLUS GRIND/OVERLAY 0.1' MIN. FROM LANE LINE TO LANE LINE.

SHOULDER TRENCH CUTS

- AT EDGE OF GUTTER - REPAIR TRENCH WIDTH ONLY (NO "T-TRENCH")
- * OFF EDGE OF GUTTER - NO LESS THAN 4' "FLOATER" BETWEEN TRENCH AND GUTTER SLURRY OR FOG SEAL MAY BE REQUIRED UNLESS THE ROADWAY IS A DESIGNATED BIKE ROUTE, WHICH WOULD REQUIRE A 0.1' THICK GRIND/OVERLAY FROM EDGE OF GUTTER TO LANE LINE.

CITY OF RANCHO MIRAGE		STANDARD DETAIL 604
REVISIONS	UTILITY TRENCH PAVEMENT REPLACEMENT	
* 7/5/2012		
	<i>[Signature]</i> 7/12/12	
	APPROVED BY: CITY ENGINEER DATE	