UTAH MUSEUM OF NATURAL HISTORY

EXHIBIT SPECIFICATIONS

80% FINAL DESIGN DOCUMENTS
PREPARED BY RALPH APPELBAUM ASSOCIATES
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GENERAL CONDITIONS

May 25, 2005

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GENERAL CONDITIONS

May 25, 2005

ARTICLE 1. GENERAL PROVISIONS.

1.1 BASIC DEFINITIONS.

A/E (including all design professionals). "A/E" means the person lawfully licensed to practice architecture or engineering or an entity lawfully practicing architecture or engineering identified as such in the A/E's Agreement and is referred to throughout the Contract Documents as if singular in number. The term "A/E" also means the A/E's representative and its subconsultants. When these General Conditions are part of a Contract in which the design professional is an interior designer, landscape subconsultant or other design professional, the term "A/E" as used in these General Conditions shall be deemed to refer to such design professional. A license is not required when the type of design professional is one which is not subject to a professional license, but such professional must meet the prevailing standards in the State of Utah for such practice. For projects where there is no A/E hired by DFCM, the references in the General Conditions to A/E shall be deemed to refer to DFCM as may be practicably applied.

ADDENDA. "Addenda" means the written or graphic instruments issued prior to the opening of Bids which clarify, correct or change the bidding documents or the Contract Documents.

ASI. "ASI" shall mean a Supplemental Instruction issued by the A/E to the Contractor which may result in clarifications or minor changes in the Work and does not affect the contract time or the contract amount.

BID. "Bid" means the offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

BONDS. "Bonds" mean the bid bond, performance and payment bonds and other instruments of security.

CHANGE ORDER. "Change Order" means a written instrument signed by the DFCM and Contractor, stating their agreement for changes of the Contract as specified on the required DFCM's change order form.

CLAIM. "Claim" means a dispute, demand, assertion or other matter submitted by the Contractor, including a Subcontractor at any tier subject to the provisions of these General Conditions. The claimant may seek, as a matter of right, modification, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. A request for Preliminary Resolution Effort (PRE) shall not be considered a "Claim." A requested amendment, requested change order, or a Construction Change Directive (CCD) is not a PRE or Claim unless agreement cannot be reached and the procedures of these General Conditions are followed.

CONSTRUCTION CHANGE DIRECTIVE. A "Construction Change Directive" means a written order signed by the DFCM, directing a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Sum or Contract Time, or both. The DFCM may by Construction Change Directive, without

invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions; even if it may impact the Contract Sum and Contract Time.

CONTRACT. The Contract Documents form the Contract for Construction. The term "Contract" represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the A/E and Contractor, (2) between the DFCM and a Subcontractor or (3) between any persons or entities other than the DFCM and Contractor.

CONTRACT DOCUMENTS. The term "Contract Documents" means the Contractor's Agreement between the DFCM and Contractor (hereinafter referred to as "Contractor's Agreement"), the Conditions of the Contract (General, Supplementary and other Conditions), the Drawings, Specifications, Addenda, other documents listed in the Contractor's Agreement and Modifications issued after execution of the Contractor's Agreement. The Contract Documents shall also include the bidding/proposal documents, including the Instructions to Bidders/Proposers, Notice to Contractors and the Bid/Proposal Form, to the extent not in conflict with the other above-stated Contract Documents and other documents and oral presentations as part of the Selection which are documented as an attachment to the Contract.

CONTRACT SUM. The term "Contract Sum" means the Contract Sum as stated in the Contractor's Agreement and, including authorized and signed adjustments to this agreement (modifications), is the total amount payable by the DFCM to the Contractor for performance of the Work under the Contract Documents.

CONTRACT TIME. "Contract Time", unless otherwise provided in the Contract Documents, means the period of time, including authorized and signed adjustments (modifications), stated in the Contract Documents for Substantial Completion of the Work.

CONTRACTOR. The Contractor is the person or entity identified as such in the DFCM Contractor's Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Contractor" means the Contractor or the Contractor's authorized representative. When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case, shall mean the Contractor who executes each separate DFCM Contractor Agreement.

CONTRACTOR'S AGREEMENT.
"Contractor's Agreement" means, unless the context requires otherwise, the agreement executed by the Contractor and DFCM for the Project.

DAY. The term "day" or "days" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

DEFECTIVE. "Defective" is an adjective which when modifying the word "Work" refers to Work that does not conform to the Contract Documents, or does not meet the requirements of any inspection, referenced standard, code, test or approval referred to in the Contract Documents, or has been damaged.

DFCM REPRESENTATIVE.
"DFCM Representative" means the Division of Facilities Construction and Management person directly assigned to work with the Contractor on a regular basis. Unless the context requires otherwise, the "DFCM Representative" is the "Owner's Representative."

DIRECTOR. "Director" means the Director of the Division of Facilities Construction and Management unless the context requires otherwise. Director may include a designee selected by the Director for the particular function referred to in the General Conditions.

DFCM. "DFCM" means the Division of Facilities Construction and Management established pursuant to Utah Code Annotated Section 63A-5-201 et seq. Unless the context requires otherwise, DFCM is the "Owner" as that term is commonly referred to in the construction industry.

DRAWINGS. The "Drawings" are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, and generally include the drawings, elevations, sections, details, schedules and diagrams.

EXECUTIVE DIRECTOR.
"Executive Director" means the Executive Director of the Department of Administrative Services, including unless otherwise stated, his/her duly authorized designee.

INSPECTION. The word "inspection" or its derivatives shall mean a review of the Project, including but not limited to a visual review of the Work completed to date to ascertain if the Work is in accordance with the Contract Documents, including all applicable building codes and construction standards.

MODIFICATION. A "Modification" is (1) a Change Order (2) Construction Change Directive or (3) ASI. The Contract may be amended or modified only by (1) a written amendment executed by both the DFCM and Contractor, or (2) by a Modification.

NOTICE TO PROCEED. A "Notice to Proceed" is a document prepared by the–DFCM and by its terms authorizes the Contractor to commence Work on the Project. It is deemed issued upon being sent by the DFCM to the Contractor's specified address within the bid or proposal.

PARTIAL USE. "Partial Use" means placing a portion of the Work in service for the purpose for which it is intended (or a related purpose) before reaching Substantial Completion for all the Work. This partial use does not constitute "substantial completion".

PRELIMINARY RESOLUTION EFFORT. "Preliminary Resolution Effort" or "PRE" means the processing of a request for preliminary resolution or any similar notice about a problem that could potentially lead to a Claim and is prior to reaching the status of a Claim.

PRODUCT DATA. "Product Data" means illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

PROJECT. The "Project" means the total construction of the Work performed under the Contract Documents.

PROJECT MANUAL (FOR CONSTRUCTION). The "Project Manual" is the volume assembled for the Work and may include the bidding/proposal requirements, sample forms, General or Supplementary Conditions of the Contract and Specifications.

PROPOSAL REQUEST OR "PR."
A "Proposal Request" or "PR" is a proposal request filed with the Contractor for the purposes of seeking a proposal in order to resolve an issue as part of the Change Order or Contract Modification process.

PROPOSED CHANGE ORDER. A "Proposed Change Order" ("PCO"), is an informal request by the Contractor filed with the DFCM Representative, in an effort to commence the Contract Modification Process. It shall not be considered a "PRE" or a "Claim." The PCO may be related to any potential, or actual delay, disruption, unforeseen condition or materials or any other matter in which the Contractor intends to seek additional monies or time.

REQUEST FOR INFORMATION or RFI. A "Request for Information" or "RFI" is a request filed by the Contractor with the A/E regarding any request for information, direction or clarification related to the Contract Documents, plans or specifications.

RESOLUTION OF THE CLAIM. "Resolution of the Claim" means the final resolution of the Claim by the Director, but does not include any administrative appeal, judicial review or judicial appeal thereafter.

RULE. "Rule," unless the context requires otherwise, shall mean a Rule of the Utah Administrative Code.

SALES TAX and/or USE TAX. Sales Tax and/or Use Tax, unless the context requires otherwise, shall mean the sales tax and/or use tax collected or to be collected by the Utah State Tax Commission and shall include any sales and/or use tax that the Utah State Tax Commission collects on behalf of any special district, local government or political subdivision.

SAMPLES. "Samples" mean physical examples, which illustrate materials, equipment or workmanship and establishes standards by which the Work will be judged.

SHOP DRAWINGS. "Shop Drawings" means drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

SPECIFICATIONS. The "Specifications" are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards, installation and workmanship for the Work, and performance of related systems and services.

SUBCONTRACTOR. "Subcontractor" means the person or entity that has a direct contract with the Contractor, including any trade contractor or specialty contractor, or with another Subcontractor at any tier to provide labor or materials for the work but does not include suppliers who provide only materials, equipment or supplies to a contractor or subcontractor. Notwithstanding the foregoing, the text in which the term is used may provide for the exclusion of Subcontractors of other Subcontractors or the exclusion of suppliers. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or authorized representative of the Subcontractor. The Term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

SUBSTANTIAL COMPLETION. "Substantial Completion" is the date certified in accordance with Article 9.2 and means the date the Work or designated portion thereof is sufficiently complete, and any lack of completion or performance does not reasonably interfere with the DFCM's intended use of the Project, in accordance with the Contract Documents so that the DFCM can occupy and use the Work for its intended use. DFCM's "intended use" or "occupy" as used in this definition, shall include any intended use or occupation by any agency or entity for which DFCM has intended to so occupy the Project.

SUPPLEMENTARY CONDITIONS OR SUPPLEMENTARY GENERAL CONDITIONS. "Supplementary Conditions" or "Supplementary General Conditions" means the part of the Contract Documents which amends or supplements these General Conditions.

WORK. The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all labor, materials, equipment and services provided, or to be provided, by the Contractor to fulfill the Contractor's obligations.

ARTICLE 2. DFCM.

2.1 INFORMATION AND SERVICES REQUIRED OF THE DFCM.

2.1.1 DFCM'S REPRESENTATIVE. The DFCM shall designate a DFCM Representative authorized to act in the DFCM's behalf with respect to the Project. The DFCM or such authorized representative shall render decisions within a reasonable time pertaining to documents submitted by the A/E and/or Contractor in order to avoid a compensable delay in the orderly and sequential progress of the Project.

2.1.2 SPECIALISTS AND INSPECTORS. The DFCM will provide certified building inspection services in accordance with the adopted Building Codes. This includes 'routine' and 'special' inspections unless otherwise noted in the A/E Agreement. The DFCM may assign an inspector or specialist to note deviations from, or necessary adjustments to, the Contract Documents or to report deficiencies or defects in the Work. The inspector or specialist's activities in no way relieves the

Contractor of the responsibilities set forth in the Contract Documents.

2.1.3 SURVEYS AND LEGAL DESCRIPTION. The DFCM shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall review this information, including the surveys and any provided soils tests, and compare such information with observable physical conditions and the Contract Documents.

2.1.4 PROMPT INFORMATION AND SERVICES. Upon receipt of a written request from the Contractor, the DFCM shall furnish information or services under the DFCM's control with reasonable promptness to avoid delay in the orderly progress of the Work.

2.1.5 COPIES OF DRAWINGS AND PROJECT MANUALS (FOR CONSTRUCTION). Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, such copies of Drawings and Project Manuals (for construction) as are reasonably necessary for execution of the Work. DFCM's Web Page may also provide referenced documents for the Project.

2.1.6 OTHER DUTIES. The foregoing is in addition to other duties and responsibilities of the DFCM enumerated herein and especially those in respect to Article 2.2 (Construction by DFCM or by Separate Contractors), Article 8 (Payments and Completion) and Article 10 (Insurance and Bonds).

2.2 CONSTRUCTION BY DFCM OR BY SEPARATE CONTRACTORS

2.2.1 DFCM'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS.

(1) **IN GENERAL**. The DFCM reserves the right to perform construction or operations related to the Project with the DFCM's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation.

(2) **COORDINATION AND REVISIONS**. The DFCM shall provide for coordination of the activities of the DFCM's own forces and of each separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the DFCM in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedule and Contract Sum deemed necessary after a joint review and agreement by the DFCM. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the DFCM until subsequently revised.

2.2.2 MUTUAL RESPONSIBILITY.

(1) **CONTRACTOR COORDINATION**. The Contractor shall afford the DFCM and separate contractor(s) a reasonable opportunity for delivery and storage of their materials and equipment and performance of their activities and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

(2) **REPORTING PROBLEMS TO DFCM**. If part of the Contractor's Work depends on work by the DFCM or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report in writing to the DFCM apparent defects in workmanship that would render it unsuitable for proper execution. Failure of the Contractor to make said report shall constitute an acknowledgment that the DFCM's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects in workmanship not then reasonably discoverable.

(3) **COSTS**. Costs caused by delays or by improperly timed activities or defective construction shall be borne by the responsible party in accordance with the procedures and provisions of the Contract Documents.

(4) **CONTRACTOR REMEDIAL WORK**. The Contractor shall promptly remedy damage caused by the Contractor to completed or partially completed Work or to property of the DFCM or separate contractors and subcontractors as provided in Article 6.

ARTICLE 3. A/E.

3.1 A/E'S ADMINISTRATION OF THE CONTRACT.

3.1.1 IN GENERAL. The A/E assists the DFCM with the administration of the Contract as described in the Contract Documents. The A/E shall have the authority to act on behalf of the DFCM only to the extent provided in the Contract Documents or A/E's Agreement.

3.1.2 SITE VISITS.

(1) Site visits or inspections by the A/E, the DFCM or any DFCM representative shall in no way limit or affect the Contractor's responsibility to comply with all the requirements and the overall design concept of the Contract Documents as well as all applicable laws, statutes, ordinances, resolutions, codes, rules, regulations, orders and decrees.

(2) **WRITTEN REPORT.** The A/E shall promptly submit to the DFCM a written report subsequent to each site visit.

3.1.3 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION. Except as authorized by the DFCM Representative or as otherwise provided in the Contract Documents, including these General Conditions, the A/E and Contractor shall communicate through the DFCM Representative on issues regarding the timing of the Work, cost of the Work or scope of the Work. Contractor shall comply with communication policies agreed upon at any pre-construction meeting with the DFCM. Communications by and with the A/E subconsultants shall be through the A/E. Communications by and with Subcontractors shall be through the Contractor. Communications by and with separate contractors shall be through the DFCM.

3.1.4 A/E MAY REJECT WORK, ORDER INSPECTION, TESTS. The A/E shall have the responsibility and authority to reject Work which, based upon the A/E's knowledge or what may be reasonably inferred from the A/E's site observations and review of data, does not conform to the Contract Documents. Whenever the A/E considers it necessary or advisable for implementation of the intent of the Contract Documents, the A/E shall have the responsibility and authority to require additional inspections or testing of the Work in accordance with the provisions of the Contract Documents, whether or not such Work is fabricated, installed or completed, provided, however, the A/E must obtain the DFCM's prior written approval of any such additional inspections or testing. However, neither this authority of the A/E nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the A/E to the Contractor, Subcontractors, their agents or employees or other persons performing portions of the Work, including separate contractors. If the Contractor disputes the rejection of any Work and the correction thereof shall involve additional cost or time, it shall be the DFCM's option to accept such Work whether it be conforming or nonconforming.

3.1.5 A/E REVIEW CONTRACTOR'S SUBMITTALS.

(1) Contractor shall submit shop drawings, product data, and samples and other submittals required by the Contract Documents to the A/E as required by the approved submittal schedule.

(2) The A/E shall review and approve or take other appropriate action upon Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the purpose of checking for conformance with the information and design concepts expressed in the Contract Documents. A/E action taken on a submittal shall not constitute a Modification of this Agreement.

(3) The A/E's action shall be taken no later than 15 days following A/E's receipt of the submittal, unless agreed to otherwise by Contractor and DFCM, in order to avoid a delay in the Work of the Contractor or of separate contractors while allowing sufficient time in the A/E's professional judgment to permit adequate review.

(4) Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents.

(5) The A/E's review of the Contractor's submittals shall not relieve the Contractor of the obligations under the Contract Documents.

(6) The A/E's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the A/E, of any construction means, methods, techniques, sequences or procedures.

(7) The A/E's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

(8) When professional certification of performance characteristics of materials, systems or equipment is required by the Contract Documents, the A/E shall be entitled to rely upon such certifications to establish that the materials systems or equipment will meet the performance criteria required by the Contract Documents.

3.2 OWNERSHIP AND USE OF A/E'S DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS. All Drawings, Specifications and other documents prepared by the A/E are and shall remain the property of the DFCM, and DFCM shall retain all common law, statutory and other reserved rights with respect thereto. Said documents were prepared and are intended for use as an integrated set for the Project which is the subject of this Contractor's Agreement. The Contractor shall not modify or use Contract Documents on any other project without the prior written consent of the DFCM and A/E. Any such non-permissive use or modification, by Contractor, the Contractor's Subcontractors at any tier or anyone for whose acts the Contractor is liable, shall be at Contractor's sole risk. Contractor shall hold harmless and indemnify the DFCM from and against any and all claims, actions, suits, costs, damages, loss, expenses and attorney fees arising out of such non-permissive use or modification by the Contractor. The Contractor and Subcontractors are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the A/E appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this license shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the A/E. Submittals or distributions necessary to meet official regulatory requirements or for other purposes relating to completion of the Project are not to be construed as a publication in derogation of the DFCM's copyright or other reserved rights.

ARTICLE 4. CONTRACTOR

4.1 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR.

4.1.1 REVIEWING CONTRACT DOCUMENTS, INFORMATION, REPORTING ERRORS, INCONSISTENCIES OR OMISSIONS. The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the DFCM pursuant to Article 2.1 hereinabove and shall at once report to the DFCM and A/E errors, inconsistencies or omissions discovered. The Contractor shall not be liable to the DFCM or A/E for damage resulting from errors, inconsistencies or omission in the Contract Documents, unless the Contractor recognized such error, inconsistency or omission or a Contractor of ordinary skill and expertise for the type of Work involved would have readily so recognized such error, inconsistency or omission, and the Contractor

failed to report such to the DFCM and A/E. If the Contractor performs any construction activity without such notice to the DFCM and A/E and prior to the resolution of the error, inconsistency or omission, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable costs for correction.

4.1.2 FIELD CONDITIONS. The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor, or information which a Contractor of ordinary skill and expertise for the type of Work involved would have known, before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the DFCM and A/E at once. If the Contractor performs any construction activity without such notice to the DFCM and A/E and prior to the resolution of the error, inconsistency or omission, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable costs for correction.

4.1.3 PERFORM IN ACCORDANCE WITH CONTRACT DOCUMENTS AND SUBMITTALS. The Contractor shall perform the Work in accordance with the Contract Documents and submittals approved in accordance with the Contract Documents

4.1.4 PERFORMANCE TO PRODUCE THE COMPLETE SYSTEM AND INTENDED RESULTS. Performance by the Contractor shall be required to the extent consistent with the Contract Documents and reasonably inferable from the Contract Documents as being necessary to allow the system to function within its intended use.

4.1.5 INTENT AND HIERARCHY. The Contract Documents should be read as a whole and wherever possible, the provisions should be construed in order that all provisions are operable. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complimentary, and what is required by one Document or provisions thereof shall be as binding as if required by all the Documents or provisions thereof. In case of an irreconcilable conflict between provisions within a Contract Document or between Contract Documents, the following priorities shall govern as listed below:

(1) A particular Modification shall govern over all Contract Document provisions or Modifications issued prior to said particular Modification.

(2) Attachments to the Contractor's Agreement resulting from the Selection process including any management plan or documented interview information shall govern over addenda, the General Conditions, plans and specifications**.**

(3) A particular Addendum shall govern over all other Contract Document provisions issued prior to said particular Addendum. Subsequent Addenda shall govern over all prior Addenda.

(4) The Supplementary General Conditions shall govern over the General Conditions.

(5) These General Conditions shall govern over all other Contract Documents except for the Supplementary General Conditions, Addenda, Modifications and Attachments resulting from the selection process.

(6) The drawings and specifications shall not govern over any of the documents listed above.

(7) In case of a conflict or ambiguity within the same level of hierarchy of described documents, DFCM reserves the right to select the most stringent requirement unless the preponderance of the contract indicates the less stringent requirement.

4.1.6 DIVIDING WORK AND CONTRACTOR REPRESENTATION. Organization of the specifications into divisions, sections and articles, and arrangement of Drawings, shall not control the Contractor in

dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Contractor represents that the Subcontractors, Sub-subcontractors, manufacturers and suppliers engaged or to be engaged by it are and will be familiar with the requirements for performance by them of their obligations.

4.1.7 PLANNING AND PRIORITY. The Contractor shall plan and schedule its work to facilitate the Project and shall maintain a work schedule to place proper priority to sequence work to complete the project timely.

4.2 SUPERVISION AND CONSTRUCTION PROCEDURES.

4.2.1 SUPERVISION AND CONTROL. The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over the construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, except to the extent that the Contract Documents expressly and specifically state otherwise.

4.2.2 RESPONSIBILITY. The Contractor shall be responsible to the State of Utah and DFCM for acts and omissions of the Contractor's employees, Subcontractors, and their agents and employees, and other persons performing portions of the Work under a contract with the Contractor or on behalf of the Contractor.

4.2.3 NOT RELIEVED OF OBLIGATIONS. The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the DFCM or its agents in the DFCM's administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor or for those that the Contractor is liable.

4.2.4 INSPECTIONS AND APPROVALS.

(1) The Contractor is responsible for requesting inspections for various stages and portions of the Work required under the Contract Documents in a timely manner.

(2) If any of the Work is required to be inspected or approved by the terms of the Contract Documents by any public authority, the Contractor shall timely request such inspection or approval to be performed in accordance with Article 9. Except as provided in Article 9, work shall not proceed without any required inspection and the associated authorization to proceed. Contractor shall promptly notify DFCM if the inspector fails to appear at the site.

4.3 LABOR AND MATERIALS.

4.3.1 PAYMENT BY CONTRACTOR. Except to the extent it is otherwise stated in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipments, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities, supplies, consumables and services necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

4.3.2 DISCIPLINE AND COMPETENCE. The Contractor shall enforce strict discipline and good order among the Contractor's employees, its Subcontractors, agents, representatives and other persons performing under the Contract Documents. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

4.4 TAXES AND OTHER PAYMENTS TO GOVERNMENT. The Contractor shall pay sales, consumer, use, employment-related and similar taxes related to the Work or portions thereof provided by the Contractor which are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect. The Contractor shall comply with the laws and regulations regarding the payment of Sales and/or Use Tax and any exemptions. The procurement documents may have a provision regarding specific items which are exempt from State of Utah Sales Tax and/or Use Tax. Any such

exemption shall be used only for the items and the project specified in the procurement documents. Any such exemption does not apply to taxes levied by the federal government or any taxing entity outside of the State of Utah. If a Contractor properly relies upon a provision(s) of the bidding or proposal documents, and if State of Utah Sales and/or Use Tax subsequently becomes due, then the Contractor shall be paid such tax amount not included in the bid/proposal amount due to the reliance upon such provision.

4.5 PERMITS, FEES, NOTICES, LABOR AND MATERIALS.

4.5.1 PERMITS AND FEES. Unless required in the Supplementary General Conditions or an Addendum, it will not be necessary for the Contractor to obtain or pay for local building permits, plan check fees, electrical permits, plumbing permits, connection fees, or impact fees, nor will it be necessary to pay fees for inspections pertaining thereto.

4.5.2 COMPLIANCE WITH PUBLIC AUTHORITIES, NOTICES. The Contractor shall comply with and give notices required by laws, ordinances, resolutions, rules, regulations and lawful orders of public authorities bearing on the performance of the Work.

4.5.3 CORRELATION OF CONTRACT DOCUMENTS AND ENACTMENTS. It is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, resolutions, building codes, and rules and regulations. Notwithstanding this, if the Contractor observes, or if such is readily observable to a Contractor of ordinary skill and expertise for the type of Work involved, that a portion of the Contract Documents is at variance therewith, the Contractor shall promptly notify the A/E and DFCM in writing, and necessary changes shall be accomplished by appropriate Modification.

4.5.4 FAILURE TO GIVE NOTICE. If the Contractor, or any Subcontractor thereof performs Work without complying with the requirements of this Article 4.5 hereinabove, the Contractor shall assume appropriate responsibility for such Work and shall bear the appropriate amount of the attributable costs.

4.6 SUPERINTENDENT. The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case.

4.7 TIME AND CONTRACTOR'S CONSTRUCTION SCHEDULES.

4.7.1 PROGRESS AND COMPLETION.

(1) **TIME IS OF THE ESSENCE; COMPLETE WITHIN CONTRACT TIME**. Time is of the essence. By executing the Contractor's Agreement, the Contractor confirms that the Contract Time is adequate to perform the Work. The Contractor shall proceed expeditiously with adequate forces to achieve Substantial Completion within the Contract Time.

(2) **NOTICE TO PROCEED AND INSURANCE**. The Contractor shall not prematurely commence operations on the site or elsewhere prior to the issuance of a Notice to Proceed by the DFCM or prior to the effective date of insurance required by Article 10 to be furnished by the Contractor, whichever is the latter.

4.7.2 SCHEDULE PREPARATION. The Contractor, promptly after being awarded the Contract, shall prepare and submit for the DFCM's and A/E's review, a reasonably detailed CPM schedule for the Work. The schedule shall indicate the order, sequence, and interdependence of all items known to be necessary to complete the Work including construction, procurement, fabrication, and delivery of materials and equipment, submittals and approvals of samples, shop drawings, procedures, or other documents. Work items of the DFCM, other Contractors, utilities and other third parties that may affect or

be affected by the Contractor shall be included. If the DFCM is required, by the Contract Documents, to furnish any materials, equipment, or the like, to be incorporated into the Work by the Contractor, Contractor shall submit, with the first schedule submittal, a letter clearly indicating the dates that such items are required at the Project Site. The critical path should be identified, including the critical paths for interim completion dates and milestones. The CPM schedule shall be developed using Primavera, MS Project, or Suretrack unless otherwise authorized by the DFCM Representative. The Contractor's schedule shall be updated at least once a month and submitted with each pay request.

4.7.3 INITIAL CONTRACT TIME. Unless otherwise specified in the bidding documents, the initial Contract Time is the time identified in the Contractor's Agreement.

4.7.4 INTERIM COMPLETION DATES AND MILESTONES. The schedule must include contractually specified interim completion dates and milestones. The milestone completion dates indicated are considered essential to the satisfactory performance of this Contract and to the coordination of all Work on the Project. The milestone dates listed are not intended to be a complete listing of all Work under this Contract or of interfaces with other Project Contractors.

4.7.5 SCHEDULE CONTENT REQUIREMENTS. The schedule shall indicate an early completion date for the Project that is no later than the Project's required completion date. The schedule, including all activity duration's shall be given in calendar days. The Schedule shall also indicate all of the following:

(1) Interfaces with the work of outside contractors (e.g., utilities, power and with any separate Contractor);

(2) Description of activity including activity number/numbers;

(3) Estimated duration time for each activity;

(4) Early start, late start, early finish, late finish date, and predecessor/successors including stop-start relationships with lead and lag time for each activity;

(5) Float available to each path of activities;

(6) Actual start date for each activity begun;

(7) Actual finish date for each activity completed;

(8) The percentage complete of each activity in progress or completed;

(9) Identification of all critical path activities;

(10) The critical path for the Project, with said path of activities being clearly and easily recognizable on the time-scaled network diagram. The path(s) with the least amount of float must be identified. Unless otherwise authorized by the DFCM Representative, no more than 40% of all activities may be identified as critical path items. The relationship between non-critical activities and activities on the critical path shall be clearly shown on the network diagram;

(11) Unless otherwise authorized by the DFCM Representative, all activities on the schedule representing construction on the site may not have a duration longer than 14 days. Construction items that require more than 14 days to complete must be broken into identifiable activities on the schedule with durations less than 14 days. The sum of these activities represents the total length required to complete that construction item; and

(12) Additional requirements as specified in the Supplemental General Conditions.

4.7.6 DFCM'S RIGHT TO TAKE EXCEPTIONS. The DFCM reserves the right to take reasonable exception to activity duration, activity placement, construction logic or time frame for any element of the Work to be scheduled.

4.7.7 FLOAT TIME. Float or slack time is defined as the amount of time between the earliest start date and the latest start date or between the earliest finish date and the latest finish date of a chain of activities on the Schedule. By a proposal request or modification delivered to the Contractor, the DFCM has the right to use the float time for non-critical path activities until the Contractor has reallocated such time on a newly submitted schedule.

4.7.8 INITIAL SCHEDULE SUBMISSION. No progress payments will be approved until the Contractor has submitted a Project detailed CPM schedule covering the first 90 days of the Work with a general CPM schedule for the entire project. The detailed schedule for the entire project is to be completed prior to the second pay request unless otherwise authorized in writing by the DFCM Representative.

4.7.9 UPDATES. Prior to any approval of a pay request, the DFCM, A/E and Contractor shall review the Contractor's schedule compared to the Work completed. The DFCM approves the amount of Work completed as supported by the schedule of values and as verified by the determination of Work completed. If necessary, the Contractor shall then update and submit to the DFCM the schedule with the pay request; all of which in accordance with the DFCM's approval. All updates shall be provided in electronic and hard copy formats. At each scheduled meeting with the DFCM Representative, the Contractor shall provide a "three week look ahead" with long lead items identified.

4.7.10 SCHEDULE OF SUBMITTALS. The Contractor shall prepare and keep current, for the A/E's and DFCM's review, a schedule of submittals required under the Contract Documents which is coordinated with the Contractor's construction schedule and allows the A/E a reasonable time to review the submittals. This submittal schedule is to be included as part of the construction schedule. Submittals requiring expedited review must be clearly identified as such in the schedule of submittals.

4.7.11 SCHEDULE RECOVERY. If the Work represented by the critical path falls behind more than 7 days, the project schedule shall be redone within 14 days showing how the Contractor shall recover the time. A narrative that addresses the changes in the schedule from the previously submitted schedule shall be submitted along with the schedule in both hard copy (appropriate report formats to be determined by the–DFCM Representative) and electronic copy. The Contractor shall comply with the most recent schedules.

4.7.12 SCHEDULE CHANGES AND MODIFICATIONS.

(1) **CONTRACT TIME CHANGE REQUIRES MODIFICATION**. The Contract Time may only be shortened or extended by a written modification fully executed by the DFCM.

(2) **CONTRACTOR REORDERING, RESEQUENCING AND CHANGING ACTIVITY DURATIONS.** Should the Contractor, after approval of the complete detailed construction schedule, desire to change his plan of construction, he shall submit his requested revisions to the DFCM and the A/E along with a written statement of the revisions including a description of the sequence and duration changes for rescheduling the work, methods of maintaining adherence to intermediate milestones and the contract completion date and the reasons for the revisions. If the requested changes are acceptable to the DFCM, which acceptance shall not be unreasonably withheld, they will be incorporated into the Schedule in the next reporting period. If after submitting a request for change in the Contract Schedule, the DFCM does not agree with the request, the DFCM will schedule a meeting with the Contractor to discuss the differences.

(3) **CHANGES IN CONTRACT TIME**. The critical path schedule as the term is used in the provisions herein shall be based on the current version of the Contractor's schedule for the Project and accepted by the DFCM just prior to the commencement of the modification, asserted delay, suspension or interruption. If the Contractor believes it is entitled to an extension of Contract Time under the Contract Documents, the Contractor shall submit a

PCO in accordance with Article 7.2 to the A/E and the DFCM Representative accompanied by an analysis ("Requested Time Adjustment Schedule") in accordance with the Contract Documents for time extensions. The "Requested Time Adjustment Schedule" shall include "fragnets" that represent the added or changed work to the Schedule. The impact on unchanged activities caused by the changes and/or delays being analyzed shall be included in these fragnets.

A "fragnet" as used in these General Conditions and when used in the context of project scheduling is a subset of project activities that are inter-related by predecessor and successor relationships that are tied into the main schedule with identified start and completion points. Each fragnet may or may not be on the critical path. An entire schedule consists of a series of inter-related fragnets.

4.7.13 EXCUSABLE DELAY.

(1) **IN GENERAL**. If the Contractor is delayed at any time in the progress of the Work on the critical path schedule by an act or neglect of the DFCM or other causes beyond the Contractor's control or by other causes which the DFCM determines may justify delay, then the Contract Time shall be extended by Change Order. The Contractor shall immediately take all steps reasonably possible to lessen the adverse impact of such delay. Notwithstanding the above, to the extent any of the causes for delay were caused by the Contractor, reasonably foreseeable by the Contractor or avoidable by the Contractor, then to such extent the delay shall not be cause for extension of the Contract Time. For purposes of this paragraph, Contractors shall include all subcontractors and others under the responsibility of the Contractor.

The determination of the total number of days extension will be based upon the current construction schedule in effect at the inception of the change and/or delay and upon all data relevant to the extension as it exists in the project record. Once approved, such data shall be incorporated in the next monthly update of the schedule.

Contractor acknowledges and agrees that delays in work items which, according to the schedule analysis, do not affect any milestone dates or the Contract completion dates shown on the CPM at the time of the delay, will not be the basis for a contract extension.

(2) **WEATHER-RELATED EXCUSABLE DELAYS**. Completion time will not be extended for normal bad weather or any weather that is reasonably foreseeable at the time of entering into the contract. The time for completion as stated in the contract documents includes due allowance for calendar days on which Work cannot be performed out of doors. The Contractor acknowledges that it may lose days due to weather conditions. Contract time may be extended at no cost to the DFCM if all of the following are met which must be established by the Contractor:

(a) That the weather prevented Work from occurring that is on the critical path for the project based upon a critical path schedule previously submitted to the DFCM and to the extent accepted by the DFCM;

(b) There are no concurrent delays attributed to the Contractor;

(c) The Contractor took all reasonable steps to alleviate the impact of the weather and took reasonable attempts to prevent the delay and despite such reasonable actions of Contractor, the weather impacted the critical path as described above; and

(d) One of the following occurred:

1. The weather was catastrophic, such as a tornado, hurricane, severe wind storm, severe hail storm; or

2. Based on the full history of information published from the closest station as indicated from the Western Regional Climate Center (Desert Research Institute 2215 Raggio Parkway Reno, Nevada 89512, and as may be described on the website at http://www.wrcc.dri.edu/summary/), one or more of the following occurred:

a. For any day between November 1 and March 31, the

minimum temperature fell below the average minimum temperature plus the extreme low temperature recorded for the month divided by 2.

b. For any day between November 1 and March 31, the maximum temperature fell below the monthly average for the minimum temperature.

c. The daily precipitation exceeded 75% of the historical one day maximum for the month.

d. The snowfall for the month exceeded 175% of the historical average snow fall for the month.

4.7.14 COMPENSABLE DELAY, SUSPENSION OR INTERRUPTION.

(1) **BASIC CONDITIONS**. In addition to the other requirements of the Contract Documents, a compensable delay, suspension or interruption of the work occurs only when the following are met:

(a) Is wholly unanticipated by the parties at the time of execution of the Contractor's Agreement or is caused by the breach of a fundamental obligation of the Contract Documents attributable to the DFCM; and

(b) The Contractor delivers a written notice to A/E and DFCM within seven (7) days that the Contractor knows or should have known of the condition giving rise to the purported compensable delay, disruption, suspension or interruption, and said continuation affects the Contract Time as indicated by the last submitted and reasonable critical path schedule.

(2) **COMPENSABLE DELAY FORMULA**. To the extent of the compensable delay, the Contractor's total entitlement for all compensable delay damages is the computed result of the following formula: Contract Sum divided by Contract Time (in calendar days); the result of which is then multiplied by 0.05; and the result of which is multiplied by the number of calendar days of compensable days allowed under these General Conditions that are beyond the Contract Time. Notwithstanding any other provision of these General Conditions or the Contract Documents, to the extent the Contractor is entitled to receive the 10% or 15% markup under Article 7.4, this provision shall be inapplicable and the markup shall be deemed to include all the compensable delay damages provided by this paragraph.

(3) **PERIOD OF COMPENSABLE DELAY, SUSPENSION OR INTERRUPTION**. The length and extent of compensable delay, shall be determined, with the use of the Project's critical path schedule, by ascertaining the number of additional days to the Contract Time that are needed in order to perform the Work in accordance with the Contract Documents as a result of the continuation of the aforesaid delay, disruption, suspension or interruption after receipt of the written notice received by the A/E and DFCM under Section 4.7.14(1)(b) above.

(4) **CONCURRENT DELAY**. Notwithstanding any other provision of these General Conditions, to the extent a non-compensable delay occurs at the same time as a compensable delay, the DFCM shall not be responsible for any compensation for the period of the non-compensable delay.

4.7.15 TIME EXTENSION REQUESTS. Any time extension shall be requested within 21 days after the Contractor knew or should have known about the delay and shall be supported by the critical path schedule analysis.

4.7.16 LIQUIDATED DAMAGES.

(1) **IN GENERAL**. Should the Contractor fail to complete the Work within the Contract Time, there shall be deducted from any amount due or that may become due the Contractor, the sum as stated in the Contractor's Agreement. Such sum is fixed and agreed upon by the DFCM and Contractor as liquidated damages due the DFCM by reason of the inconvenience and added costs of administration, engineering, supervision and other costs resulting from the Contractor's default, and not as a penalty. Actual damages related to delay can not be ascertained at

the time of execution of the Contract. To the extent that the liquidated damages exceed any amounts that would otherwise be due the Contractor, the Contractor shall be liable for such excess to the DFCM. DFCM may seek enforcement of such obligation by legal action, and if such is necessary, shall recover the related costs and attorney fees. Notwithstanding any other provision of these General Conditions, the availability of liquidated damages to the DFCM shall not limit the DFCM's right to seek damages or other remedies available under law or equity to the extent such damages or remedies are not based upon delay.

(2) **NO WAIVER OF DFCM'S RIGHTS**. Permitting the Contractor to continue any part of the Work after the time fixed for completion or beyond any authorized extension thereof, shall in no way operate as a waiver or estoppel on the part of the DFCM of any of its rights under the Contract Documents, including the right to liquidated damages or any other remedies or compensation.

4.8 DOCUMENTS AND SAMPLES AT THE SITE, CERTIFYING "AS-BUILTS". The Contractor shall maintain at the site for the DFCM, one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked weekly to record changes and selections made during construction, as well as approved Shop Drawings, Product Data, Samples and similar submittals. These aforesaid items shall be available to the A/E and shall be delivered to the A/E for submittal to the DFCM upon completion of the Work, signed by the Contractor, certifying that they show complete and exact "as-built" conditions, stating sizes, kind of materials, vital piping, conduit locations and similar matters. All notes of encountered or changed conditions shall be included.

4.9 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

4.9.1 NOT CONTRACT DOCUMENTS. Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The submittal shall demonstrate, for those portions of the Work for which the submittal is required, the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.

4.9.2 PROMPTNESS. The Contractor shall review, approve and submit to the A/E, Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work, or the activities of the DFCM or separate contractors.

4.9.3 NOT PERFORM UNTIL A/E APPROVES. The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved in writing by the A/E. Such Work shall be in accordance with the approved submittals.

4.9.4 REPRESENTATIONS BY CONTRACTOR. By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

4.9.5 CONTRACTOR'S LIABILITY. The Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the A/E's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the A/E in writing of such deviation at the time of the submittal and the A/E has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the A/E's review and comment.

4.9.6 DIRECT SPECIFIC ATTENTION TO REVISIONS. The Contractor shall direct specific attention in writing to all revisions on resubmitted Shop Drawings, Product Data, Samples or similar submittals, except those

requested by the A/E and indicated on previous submittals.

4.9.7 INFORMATIONAL SUBMITTALS. Informational submittals upon which the A/E is not expected to take responsive action may be so identified in the Contract Documents.

4.9.8 RELIANCE ON PROFESSIONAL CERTIFICATION. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the DFCM and A/E shall be entitled to rely upon the accuracy and completeness of such calculations and certifications. If a professional stamp is required, the professional shall be licensed in the State of Utah unless otherwise approved by the DFCM in writing. Likewise, the Contractor is entitled to rely upon the accuracy and completeness of the calculations made by the A/E in developing the Contract Documents, unless a Contractor of ordinary skill and expertise for the type of Work involved would know that such is inaccurate or incomplete and therefore must immediately notify the DFCM in writing.

4.10 USE OF SITE.

4.10.1 IN GENERAL. The Contractor shall confine operations at the site to areas permitted by the Contract Documents, law, ordinances, resolutions, rules and regulations, and permits and shall not unreasonably encumber the site with materials or equipment. Contractor shall take all reasonable means to secure the site, protect the site and protect the Work from any damage. The site shall be left free and clear of refuse, equipment, materials, etc. and the site shall not be subject to spilled liquids and chemicals, toxic or otherwise. Should such an incident occur while the Contractor has control of the site, the Contractor shall be responsible to clean the site and pay all associated costs, fines and penalties. Notwithstanding this, Contractor is not responsible for any damage to the site or the Work to the extent caused by the DFCM or the DFCM's agents.

4.10.2 ACCESS TO NEIGHBORING PROPERTIES. The Contractor shall not, except as provided in the Contract Documents or with the DFCM's advance written consent when necessary to perform the Work, interfere with access to properties neighboring the Project site by the owners of such properties and their respective tenants, agents, invitees and guests.

4.11 ACCESS TO WORK. The Contractor shall provide the DFCM and A/E access to the Work in preparation and progress, wherever located.

4.12 ROYALTIES AND PATENTS. The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of patent rights and shall hold the DFCM and A/E harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the DFCM in writing.

4.13 INDEMNIFICATION.

4.13.1 IN GENERAL.

(1) To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the State of Utah, the State of Utah's institutions, agencies, departments, divisions, authorities, and instrumentalities, boards, commissions, elected or appointed officers, employees, agents, authorized volunteers (hereinafter the above listing of entities and persons is referred to an "indemnities") from and against every kind and character of claims, damages, losses and expenses, including but not limited to attorneys' fees, and including those events covered under the blanket Contractual Liability Coverage required under the Contract Documents, arising out of or resulting from any act or omission in the performance of the Work including the work of all the Subcontractors and their employees, provided that any such claim, damage, loss or expense is caused in whole or in part by the negligent or wrongful act or omission

of the Contractor, any Subcontractor, and their employees, provided that any such claim, damage loss or expense is caused in whole or in part by the negligent or intentional act or omission of the Contractor, any Subcontractor, or anyone directly or indirectly employed or the agent of any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder. The Contractor shall defend all actions brought upon such matters to be indemnified hereunder and pay all costs and expenses incidental thereto, but the State of Utah shall have the right, at its option, to participate in the defense of any such action without relieving the Contractor of any obligation hereunder. Notwithstanding any of the above, to the extent the Contractor is complying with a written directive from the DFCM, that is not based on the Contractor's recommendation, the Contractor shall not be held liable under the indemnification provision of this Agreement if the Contractor has promptly disagreed with the written directive by delivering such objection to the DFCM in writing.

(2) Such obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person under Contract Documents.

(3) In claims against any person or entity indemnified under this Article 4.13 by an employee of the Contractor, Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Article 3.13 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or Subcontractor under workers' or workmen's compensation acts, disability benefits acts or other employee benefit acts.

ARTICLE 5. SUBCONTRACTORS.

5.1 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK.

5.1.1 APPROVAL REQUIRED.

(1) Listing of Subcontractors shall be as required by U.C.A. 63A-5-208 as amended and/or as stated in the Contract Documents, including but not limited to the "DFCM Subcontractors List Form".

(2) The Contractor shall not contract with a proposed person or entity to whom the DFCM has made a reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

5.1.2 BUSINESS AND LICENSING REQUIREMENTS. All Subcontractors used by the Contractor shall comply with all applicable business and licensing requirements.

5.1.3 SUBSEQUENT CHANGES. After the lapse of twenty-four (24) hours from the bid opening, the Contractor may change its listed Subcontractors only in accordance with Rule R 23-1 and the Contract Documents and with written approval of the Director of the Division of Facilities Construction and Management.

(1) DFCM will pay the additional costs for a DFCM requested change in subcontractor if all of the following are met:

(a) If the DFCM in writing requests the change of a subcontractor;

(b) The original subcontractor is a responsible subcontractor that meets the requirements of the Contract Documents; and

(c) The original subcontractor did not withdraw as a subcontractor on the project.

(2) In all other circumstances, the Contractor shall pay the additional cost for a change in a subcontractor.

5.1.4 BONDING OF SUBCONTRACTORS. Subcontractors as identified by DFCM in the procurement documents, may be required to submit

performance and payment bonds to cover the full extent of their portion of the Work. This provision does not in any way limit the right of the Contractor to have subcontractors at any tier be required to have a performance and/or payment bond.

5.2 SUBCONTRACTUAL RELATIONS.

5.2.1 COMPLY WITH CONTRACT DOCUMENTS. By appropriate enforceable agreement, and to the extent it can be practically applied, the Contractor shall require each Subcontractor to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Documents, assumes towards the DFCM and A/E.

5.2.2 RIGHTS. Each Subcontractor agreement shall preserve and protect the rights of the DFCM and A/E under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the Subcontractor agreement, the benefit of all rights and remedies against the Contractor that the Contractor, by the Contract Documents, has against the DFCM.

5.2.3 SUB-SUBCONTRACTORS. The Contractor shall require each Subcontractor to enter into similar agreements with its Subcontractors which complies with the requirements of Paragraphs 5.2.1 and 5.2.2 hereinabove.

5.2.4 DOCUMENT COPIES. The Contractor shall make available to each proposed Subcontractor, prior to execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound. Subcontractors shall similarly make copies of applicable portions of the Contract Documents available to their respective proposed Subcontractors.

5.3 CONTINGENT ASSIGNMENT OF SUBCONTRACTS.

5.3.1 CONDITIONS FOR ASSIGNMENT TO DFCM. Each subcontract agreement for a subcontractor at any tier for a portion of the Work is assigned by the Contractor to the DFCM provided that the assignment is effective only after termination of the Contract by the DFCM for cause pursuant to Article 12.2 or stoppage of the Work by DFCM pursuant to Article 12.5, and only for those subcontract agreements which the DFCM accepts by notifying the Subcontractor in writing. The subcontract shall be equitably adjusted to meet the new conditions of the work.

ARTICLE 6. PROTECTION OF PERSONS AND PROPERTY.

6.1 SAFETY OF PERSONS AND PROPERTY.

6.1.1 CONTRACTOR RESPONSIBILITY. The Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall take all reasonable precautions for the safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

(1) Employees on the Work and other persons who may be affected thereby;

(2) The Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or a Subcontractor; and

(3) Other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

6.1.2 SAFETY PROGRAM, PRECAUTIONS. The Contractor shall institute a safety program at the start of construction to minimize accidents. Said program shall continue to the final completion of the Project and conform to applicable laws and regulations including the Utah Occupational Safety and Health Rules and

Regulations as published by the Utah Industrial Commission - UOSH Division. The Contractor shall post signs, erect barriers, and provide those items necessary to implement the safety program. As soon as the Contractor proceeds with the Work, the Contractor shall have all workers and all visitors on the site wear safety hard hats, as well as all other appropriate safety apparel such as safety glasses and shoes, and obey all safety rules and regulations and statutes. The Contractor shall post a sign in a conspicuous location indicating the necessity of wearing hard hats and the Contractor shall loan such hats to visitors.

6.1.3 COMPLIANCE WITH LAWS. The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss. In particular, the Contractor shall comply with all applicable provisions of Federal, State and municipal safety laws, rules and regulations as well as building codes to prevent accidents or injury to persons on, about, or adjacent to the premises where the Work is being performed.

6.1.4 ERECT AND MAINTAIN SAFEGUARDS. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including effective fences, posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

6.1.5 UTMOST CARE. When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

6.1.6 PROMPT REMEDY. The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Paragraph 6.1.1 of these General Conditions caused in whole or in part by the Contractor, a Subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under said Paragraph 6.1.1, except to the extent such damage or loss is directly due to errors in the Contract Documents or caused by agents or employees of the A/E or DFCM. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under the Contract Documents.

6.1.7 SAFETY DESIGNEE. The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents, damage, injury or loss. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the DFCM and A/E.

6.1.8 LOAD SAFETY.
The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

6.1.9 OFF-SITE RESPONSIBILITY. In addition to its other obligations under this Article 6, the Contractor shall, at its sole cost and expense, promptly repair any damage or disturbance to walls, utilities, streets, ways, sidewalks, curbs and the property of the State and third parties (including municipalities and other governmental agencies) resulting from the performance of the Work, whether by it or by its Subcontractors at any tier. The Contractor shall not cause materials, including soil and debris, to be placed or left on streets or ways.

6.1.10 EMERGENCIES.
In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Contractor shall promptly notify the DFCM Representative of the action taken.

6.2 HAZARDOUS MATERIALS. In the event the Contractor encounters on the site material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) or any other hazardous waste or substance which may endanger the health of those persons performing the Work or being on the site**,** the Contractor shall immediately stop Work in the area affected and

immediately report the condition to the DFCM Representative and A/E by phone with a follow-up document in writing. The Work in the affected area shall be resumed when written direction is provided by the DFCM Representative. Except to the extent provided otherwise in the Contract Documents or if the presence of hazardous materials is due to the fault of the Contractor, the Contractor shall not be required to perform without the Contractor's consent, any Work relating to asbestos, polychlorinated biphenyl (PCB) or any other hazardous waste or substance.

DFCM shall procure a licensed abatement contractor qualified to remove the hazardous material. The abatement contractor shall submit notification of demolition to the Utah Division of Air Quality. Abatement contractor shall pay the notification fee. A copy of the hazardous material survey report shall be available to all persons who have access to the construction site.

6.3 HISTORICAL AND ARCHEOLOGICAL CONSIDERATIONS. In the event the Contractor knows or should have known of any cultural, historical or archeological material that is either recognized as an item to be protected under Federal, State, or local law or regulation, or is an item of obvious value to the State of Utah, the Contractor shall cease any work that would interfere with such discovery and immediately report the condition to the DFCM Representative and A/E by phone with a follow-up document in writing. Work shall resume based upon the direction of the DFCM Representative. Contractor cooperation with any DFCM recognized archaeologist or other cultural/historical expert is required.

6.4 CONTRACTOR LIABILITY. If the Contractor fails in any of its obligations in Articles 6.1 through 6.3 above, the Contractor shall be liable to any damages to DFCM, the State of Utah or any third party resulting from such noncompliance. The Contractor shall also be liable for any mitigation or restoration effort resulting from such noncompliance. To the extent all the following is met, the Contractor may treat the discovery of such material similarly to an unforeseen condition:

6.4.1 The discovery of such material is reasonably unforeseeable given the site conditions that the Contractor should have been aware;

6.4.2 The presence of such material was not identified in any part of the Contract Documents;

6.4.3 The Contractor has undertaken all proper action to mitigate any impact of such discovery on the critical path or monies related to the Project;

6.4.4 The discovery affects the critical path or contract price from that which was contemplated by the Contract Documents; and

6.4.5 The requirements of 7.1.5 and the Contract documents are met.

ARTICLE 7. MODIFICATIONS, REQUEST FOR INFORMATION, PROPOSED CHANGE ORDER, PRELIMINARY RESOLUTION EFFORTS AND CLAIMS PROCESS.

7.1 MODIFICATIONS: IN GENERAL.

7.1.1 TYPES OF MODIFICATIONS AND LIMITATIONS. Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or ASI, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents. The Contractor must have a written Modification executed by DFCM under this Article 7 prior to proceeding with any Work sought to be an extra.

7.1.2 BY WHOM ISSUED. A Change Order or Construction Change Directive shall be issued by the DFCM Representative. An ASI is issued by the A/E or by the DFCM Representative.

The A/E shall prepare Change Orders and Construction Change Directives with specific documentation and data for the DFCM's approval and execution in accordance with the Contract Documents, and may issue ASIs not involving an adjustment in the contract sum or an extension of the Contract Time which are not

inconsistent with the intent of the Contract Documents.

7.1.3 CONTRACTOR TO PROCEED UNLESS OTHERWISE STATED. Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or ASI.

7.1.4 ADJUSTING UNIT PRICES. If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are so changed in a proposed Change Order or Construction Change Directive that application of such unit prices to quantities of Work proposed will cause a substantial inequity to the DFCM or Contractor, the applicable unit prices may be equitably adjusted.

7.1.5 SPECIAL NOTICES REQUIRED IN ORDER TO BE ELIGIBLE FOR ANY CONTRACT MODIFICATION. In order to be eligible for any Modification under this Article 7, the Contractor must have met the following special notice requirements:

(1) **CONCEALED OR UNKNOWN CONDITIONS**. The Contractor must file a written notice with the DFCM Representative within seven (7) calendar days of that the Contractor knew or should have known of a site condition described below or the Contractor shall be deemed to waive any right to file any PCO, PRE or Claim for additional monies or time related to such condition:

(a) If the Contractor encounters unknown and reasonably unforeseeable subsurface or otherwise concealed physical conditions, including hazardous or historical/cultural materials under Article 6, which differ materially from those indicated by the Contract Documents or a site inspection; or

(b) If the Contractor encounters unknown physical conditions of an unusual nature which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents.

(2) **INCREASE IN CONTRACT TIME**. If the Contractor encounters a situation in which the Contractor knows or should have known that such situation would cause a delay, disruption, interruption, suspension or the like to the Project, the Contractor must file a notice with the DFCM Representative within seven (7) working days of when the Contractor knew or should have known of such circumstance or the Contractor shall be deemed to waive any right to file any PCO, PRE or Claim for additional monies or time related to such circumstance. To the extent the DFCM and/or the State of Utah is damaged by the failure of the Contractor to provide such notice after the Contractor knows or should have known of such circumstance, the Contractor shall be liable for liquidated damages attributable thereto, as well as any damages to the State of Utah and/or DFCM that are allowable in addition to liquidated damages.

7.2 CONTRACTOR INITIATED REQUESTS.

7.2.1 THE REQUEST FOR INFORMATION, RFI, PROCESS AND TIME TO FILE. The Contractor may file an RFI with the A/E regarding any concern which will assist the Contractor in the proper completion of the Work including, but not limited to issues related to the Contract Documents, plans and specifications. The RFI shall be filed with the A/E in a timely manner so as not to prejudice the DFCM as to the quality, time or money related to the Work.

7.2.2 PROPOSED CHANGE ORDER ("PCO"). Within twenty-one (21) days after the Contractor knows or should have known of a situation or concern where the Contractor is going to request additional monies or time, the Contractor must file a Proposed Change Order ("PCO") with the DFCM Representative, or the Contractor shall be deemed to waive any right to claim additional monies or time related to such situation or concern. The PCO shall include all available documentation supporting the PCO available to the Contractor at the time of filing and the Contractor shall thereafter diligently pursue the

supplementation(s) of such documentation and promptly deliver such supplementation(s) to the DFCM Representative.

(1) **DFCM REPRESENTATIVE RESPONSE.** One of the following may occur after a PCO is filed with the DFCM Representative:

(a) The DFCM Representative, after considering any input by the A/E, may reach an agreement with the Contractor and issue a Change Order.

(b) The DFCM, after considering any input by the A/E, may issue a Construction Change Directive.

(c) If the DFCM Representative, after considering any input by the A/E, disagrees with the Contractor's PCO, the DFCM representative may seek additional information or verification from the Contractor, the A/E or other sources, may negotiate with the Contractor, may issue a Change Order upon such later agreement, may retract the PR, or may issue a Construction Change Directive.

(d) If a Construction Change Directive is issued which identifies the DFCM Representative's position in regard to the subject contract sum and/or time adjustment or if the PCO is denied by the DFCM Representative, the Contractor must file a PRE under Article 7.7 below no later than twenty-one (21) days after the Contractor's receipt of the Construction Change Directive or such denial of the PCO. Failure to file a PRE in these instances shall be deemed to waive any right to additional time or money related to the PCO, Construction Change Directive or denial of the PCO. Such waiver shall entitle the DFCM to convert the Construction Change Directive into a Change Order, whether or not executed by the Contractor.

If the Construction Change Directive leaves open the determination of additional time or money related to the directed change, then the time period for commencement of filing the PRE shall not accrue until such time as the DFCM has conveyed to the Contractor a position as to the time and money owing as a result of the directed change.

The A/E must continually work with the DFCM in providing data, documentation and efforts to resolve the issues related to the PR.

7.3 PROPOSAL REQUEST INITIATED BY DFCM. DFCM may file a Proposal Request with the Contractor seeking information, data and/or pricing relating to a change in the contract time and or monies owing for particular scope changes or other modifications to the Contract Documents. The PR shall provide a time limit for the Contractor to file a response with the A/E and the DFCM Representative. If a proposal is not timely provided by the Contractor, DFCM may calculate the Change Order under Article 7.4.2 below. Upon such timely receipt of the proposal, one of the following shall occur:

7.3.1 IF AGREEMENT, CHANGE ORDER ISSUED. The DFCM Representative, after considering any input by the A/E, may reach an agreement with the Contractor and issue a Change Order.

7.3.2 IF DISAGREEMENT. If the DFCM Representative disagrees with the Contractor's proposal, after considering any input from the A/E, the DFCM representative may seek additional information or verification from the Contractor or other sources, may negotiate with the Contractor, may issue a Change Order upon such later agreement, may retract the PR, or may issue a Construction Change Directive. If a Construction Change Directive is issued which identifies the DFCM representative's position in regard to the subject contract sum and/or time adjustment, the Contractor must file a PRE within twenty-one (21) days of the Contractor's receipt of the Construction Change Directive, or the Contractor shall be deemed to waive any such request for additional time or money as a result of the issuance of the Construction Change Directive. Such waiver shall entitle the DFCM to convert the Construction Change Directive into a Change Order, whether or not executed by the Contractor. If the Construction Change Directive leaves open the determination of additional time or money related to the directed change, then the time period for commencement of filing the PRE shall not accrue until such time as the DFCM has conveyed

to the Contractor a position as to the time and money owing as a result of the directed change.

7.4 EVALUATION OF PROPOSAL FOR ISSUING CHANGE ORDERS.

7.4.1 ADJUSTING SUM BASED UPON AGREEMENT. If the Change Order provides for an adjustment to the Contract Sum, the adjustment shall be based on the mutual agreement of the Contractor and DFCM, including any terms mandated by unit price agreements or other terms of the Contract Documents.

7.4.2 DFCM RESOLUTION OF SUM AND STANDARDS IN THE ABSENCE OF AN AGREEMENT UNDER PARAGRAPH 7.4.1. In the absence of an agreement under Paragraph 7.4.1 above, the adjustment shall be based on an itemized accounting of costs and savings supported by appropriate data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Paragraph shall be limited to the following:

(1) All direct and indirect costs of labor; including workers compensation insurance, social security and other federal and state payroll based taxes, and payroll based fringe benefits paid by Contractor so long as they are reasonable and no higher than that charged to other clients;

(2) Costs of materials, on-site temporary facilities, supplies and equipment (except hand tools) required for or incorporated into the work;

(3) Rental costs of machinery, equipment, tools (except hand tools), and on-site temporary facilities, whether rented from the Contractor or others;

(4) Costs of permits and other fees, sales, use or similar taxes related to the Work;

(5) Additional costs of field supervision and field office personnel directly attributable to the change; and

(6) Overhead and profit by the following liquidated formula which is not a penalty but a reasonable calculation agreed upon at the time of execution of the Contractor's Agreement, and provided by formula herein due to the fact that the actual amount due for said overhead and profit cannot easily be ascertained at the time of such execution. The markups in 7.4.2(6)(a) and (b) below are to cover the Contractor's additional payment and performance bond premiums, insurance premiums not specified under Paragraph 7.4.2(1), home office and on-site overhead and profit. Overhead and profit includes, but is not limited to the Contractor's Project Manager and Cost Estimator. Each request for pricing shall stand on its own and not be combined with other requests for pricing in determining the allowed markup described below. A particular request for pricing shall include all items reasonably related together and determinable at the time of the request. If several unrelated requests for pricing are grouped together in a single Change Order, each request for pricing will be considered separately for purposes of calculating the markup under the following formula:

(a) A markup of 15% shall be applied to the cost of each individual charge up to $20,000 in cost, but in no case shall the markup be less than $150;

(b) A markup of 10% shall be applied to the portion of the cost of each individual charge in excess of $20,000;

(c) Subcontractors at any tier shall be entitled to markup their costs related to a Change Order with the same percentages as specified in Paragraphs 7.4.2(6)(a) and (b) above, except that the minimum markup shall be $50 for any individual change.

7.4.3 CREDITS. The amount of credit to be allowed by the Contractor to the DFCM for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed to DFCM based upon corroboration by an appropriate source.

7.5 CONSTRUCTION CHANGE DIRECTIVES.

7.5.1 WHEN USED AND CONTRACTOR'S RIGHT TO CHALLENGE. A Construction Change Directive may be issued by the DFCM Representative in the case of a need for the Work to commence. If the Construction Change Directive leaves open the determination of additional time or money related to the directed change, then the Construction Change Directive shall indicate the timeframe(s) in which further information is to be provided to resolve the matter. At any time that the DFCM and the Contractor agree upon the time and money related to a Construction Change Directive, a Change Order shall be executed by the parties. Additionally, the Construction Change Directive may be converted to a Change Order under Paragraph 7.2.2 or Article 7.3 above.

7.5.2 PROCEED WITH WORK AND NOTIFY DFCM ABOUT ADJUSTMENT METHOD. Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved.

7.5.3 INTERIM PAYMENTS BY DFCM. Pending the final determination of the total cost of the Construction Change Directive, DFCM shall pay any undisputed amount to the Contractor.

7.6 A/E'S SUPPLEMENTAL INSTRUCTION (Commonly referred to as an "ASI"). The A/E may at any time that is consistent with maintaining the quality, safety, time, budget and function of the Work, issue to the Contractor a supplemental instruction ("ASI") after approval from the DFCM Representative is obtained. The Contractor must file with the DFCM Representative a PCO under Paragraph 7.2.2 above, within 21 calendar days of the Contractor's receipt of the ASI, or the Contactor shall be deemed to have waived any right to additional time or monies as a result of such ASI.

7.7 PROCEDURE FOR PRELIMINARY RESOLUTION EFFORTS.

7.7.1 REQUEST FOR PRELIMINARY RESOLUTION EFFORT (PRE). A Contractor raising an issue related to a breach of contract or an issue concerning time or money shall file a PRE as a prerequisite for any consideration of the issue by the DFCM. The labeling of the notice or request shall not preclude the consideration of the issue by the DFCM.

7.7.2 TIME FOR FILING. The PRE must be filed in writing with the DFCM Representative within twenty-one (21) days of any of the following:

(1) Issuance of a Construction Change Directive that defines the time and sum due the Contractor but the Contractor disagrees with such assessment;

(2) Issuance of DFCM's position in regard to a Construction Change Directive that originally left open the time and/or sum due to the Contractor;

(3) Issuance of a denial of a PCO by DFCM;

(4) In the case of a Subcontractor, after the expiration of the time period for the Contractor/Subcontractor PRE process under Paragraph 7.7.5 below; or

(5) When the Contractor knows or should have known about any other issue where the Contractor seeks additional monies, time or other relief from the State of Utah or DFCM.

7.7.3 CONTENT REQUIREMENT. The PRE shall be required to include in writing to the extent information is reasonably available at the time of such filing:

(1) A description of the issue;

(2) The potential impact on cost and time or other breach of contract; and

(3) An indication of the relief sought.

7.7.4 SUPPLEMENTATION. Additional detail of the content requirement under Paragraph 7.7.3 above shall be provided later if the detail is not yet available at the initial filing as follows:

(1) While the issue is continuing or the impact is being determined, the Contractor shall provide a written updated status report every 30 days or as otherwise reasonably requested by the DFCM Representative; and

(2) After the scope of work or other factors addressing the issue are completed, the complete information, including any impacts on time, cost or other relief requested, must be provided to the DFCM Representative within twenty-one (21) days of such completion.

7.7.5 SUBCONTRACTORS.

(1) Under no circumstances shall any provision of these Contract Documents be intended or construed to create any contractual relationship between the DFCM and any Subcontractor.

(2) The Contractor must include the provisions of this Paragraph 7.7.5 in its contract with the first tier Subcontractor, and each Subcontractor must do likewise. At the Contractor's discretion, the Contractor may allow a Subcontractor at the 2nd tier and beyond to submit the PRE directly with the Contractor.

(3) In order for a Subcontractor at any tier to be involved with the PRE of the DFCM, the following conditions and process shall apply:

(a) The Subcontractor must have attempted to resolve the issue with the Contractor including the submission of a PRE with the Contractor.

(b) The Subcontractor must file a copy of the PRE with the DFCM Representative;

(c) The PRE to the Contractor must meet the time, content and supplementation requirements of Paragraphs 7.7.2, 7.7.3 and 7.7.4. The triggering event for a Subcontractor to file a PRE shall be the time at which the issue cannot be resolved through the normal business practices associated with the contract, excluding arbitration and litigation;

(d) The PRE submitted to the Contractor shall only be eligible for consideration in the DFCM's PRE process to the extent the issue is reasonably related to the performance of the DFCM or an entity for which the DFCM is liable;

(e) The Contractor shall resolve the PRE to the satisfaction of the Subcontractor within sixty (60) days of its submittal to the Contractor or such other time period as subsequently agreed to by the Subcontractor in writing. If the Contractor fails to resolve the PRE with the Subcontractor within such required time period, the Subcontractor may submit in writing the PRE with the Contractor and the DFCM. In order to be eligible for DFCM consideration of the PRE, the Subcontractor must submit the PRE within twenty-one (21) days of the expiration of the time period for the Contractor/Subcontractor PRE process. The DFCM shall consider the PRE as being submitted by the Contractor on behalf of the Subcontractor;

(f) Upon such PRE being submitted, the Contractor shall cooperate with the DFCM Representative in reviewing the issue;

(g) The DFCM shall not be obligated to consider any submission which is not in accordance with any provision of this Article 7.7;

(h) The Subcontractor may accompany the Contractor in participating with the DFCM regarding the PRE raised by the Subcontractor. The DFCM is not precluded from meeting with the Contractor separately and it shall be the responsibility of the Contractor to keep the Subcontractor informed of any such meetings; and

(i) Notwithstanding any provision of this Paragraph 7.7.5, a Subcontractor shall be entitled to pursue a payment bond claim.

7.7.6 PRE RESOLUTION PROCEDURE. The DFCM Representative may request additional information and may meet with the parties involved with the issue.

7.7.7 CONTRACTOR REQUIRED TO CONTINUE PERFORMANCE. Pending the final resolution of the issue, unless otherwise agreed upon in writing by the DFCM Representative, the Contractor shall proceed diligently with performance of the Contract and the DFCM shall continue to make payments in accordance with the Contract Documents.

7.7.8 DECISION. The DFCM shall issue to the Contractor, and any other party brought into the process by the DFCM Representative as being liable to the DFCM, a written decision providing the basis for the decision on the issues presented by all of the parties within thirty (30) days of receipt of all the information required under Paragraphs 7.7.3 and 7.7.4.

7.7.9 DECISION FINAL UNLESS CLAIM SUBMITTED. The decision by the DFCM shall be final, and not subject to any further administrative or judicial review (not including judicial enforcement) unless a Claim is submitted in accordance with these General Conditions.

7.7.10 EXTENSION REQUIRES MUTUAL AGREEMENT. Any time period specified in this Article 7.7 may be extended by mutual agreement of the Contractor and the DFCM.

7.7.11 IF DECISION NOT ISSUED. If the decision is not issued within the thirty (30) day period, including any agreed to extensions, the issue may be pursued as a Claim.

7.7.12 PAYMENT FOR PERFORMANCE.

(1) Except as otherwise provided in the Contract Documents, any final decision where the DFCM is to pay additional monies to the Contractor, shall not be delayed by any PRE, Claim or appeal by another party.

(2) Payment to the Contractor of any final decision shall be made by the DFCM in accordance with the contract for the completed work.

(3) Notwithstanding any other provision of the Contract Documents, payment to the Contractor shall be subject to any set-off, claims or counterclaims of the DFCM.

(4) Payment to the Contractor for a Subcontractor issue submitted by the Contractor shall be paid by the Contractor to the Subcontractor in accordance with the contract between the Contractor and the Subcontractor.

(5) Any payment or performance determined owing by the Contractor to the DFCM shall be made in accordance with the Contract Documents.

7.8. RESOLUTION OF CLAIM.

7.8.1 CLAIM. If the decision on the PRE is not issued within the required timeframe or if the Contractor is not satisfied with the decision, the Contractor or other party brought into the process by the DFCM, may submit a Claim in accordance with this Article 7.8 as a prerequisite for any further consideration by the DFCM or the right to any judicial review of the issue giving rise to the claim.

7.8.2 SUBCONTRACTORS. In order for a Subcontractor to have its issue considered in the Claim process by the DFCM, the Subcontractor that had its issue considered under Paragraph 7.7.5 may submit the issue as a Claim by filing it with the Contractor and the DFCM within the same timeframe and with the same content requirements as required of a Claim submitted by the Contractor under this rule. The DFCM shall consider the Claim as being submitted by the Contractor on behalf of the Subcontractor. Under no circumstances shall any provision of these General Conditions or the Contract Documents be intended or construed so as to create any contractual relationship between the DFCM and any Subcontractor.

(1) Upon such Claim being submitted, the Contractor shall fully cooperate

with the Director, the person(s) evaluating the claim and any subsequent reviewing authority.

(2) The Director shall not be obligated to consider any submission which is not in accordance with this Paragraph 7.8.2.

(3) The Subcontractor may accompany the Contractor in participating with the Director, the person(s) evaluating the Claim and any subsequent reviewing authority regarding the Claim. The Director, the person(s) evaluating the Claim and any subsequent reviewing authority is not precluded from meeting with the Contractor separately, and it shall be the responsibility of the Contractor to keep the Subcontractor informed of any such meetings and matters discussed.

(4) Notwithstanding any provision of this Article 7.8, a Subcontractor shall be entitled to pursue a payment bond claim.

7.8.3 TIME FOR FILING. The Claim must be filed in writing promptly with the Director, but in no case more than twenty-one (21) days after the decision is issued on the PRE under Paragraph 7.7.8 or no more than twenty-one (21) days after the thirty (30) day period under Paragraph 7.7.11 has expired with a decision not issued, whichever is later.

7.8.4 CONTENT REQUIREMENT. The written Claim shall include:

(1) A description of the issues in dispute;

(2) The basis for the Claim, including documentation and analysis required by the contract and applicable law and rules that allow for the proper determination of the Claim;

(3) A detailed cost estimate for any amount sought, including copies of any related invoices; and

(4) A specific identification of the relief sought.

7.8.5 EXTENSION OF TIME TO SUBMIT DOCUMENTATION. The time period for submitting documentation and any analysis to support a Claim may be extended by the Director upon written request of the claimant showing just cause for such extension, which request must be included in the initial Claim submittal.

7.8.6 CONTRACTOR REQUIRED TO CONTINUE PERFORMANCE. Pending the final determination of the Claim, including any judicial review or appeal process, and unless otherwise agreed upon in writing by the Director, the Contractor shall proceed diligently with performance of the Contract and the DFCM shall continue to make payments in accordance with the Contract Documents.

7.8.7 AGREEMENT OF CLAIMANT ON METHOD AND PERSON(S) EVALUATING THE CLAIM. The Director shall first attempt to reach agreement with the claimant on the method and person(s) to evaluate the Claim. If such agreement cannot be made within fourteen (14) days of filing of the Claim, the Director shall select the method and person(s), considering the purposes described in Rule R23-26-1. Unless agreed to by the Director and the claimant, any selected person shall not have a conflict of interest or appearance of impropriety. Any party and the person(s) evaluating the Claim has a duty to promptly raise any circumstances regarding a conflict of interest or appearance of impropriety. If such a reasonable objection is raised, and unless otherwise agreed to by the Director and the claimant, the Director shall take appropriate action to eliminate the conflict of interest or appearance of impropriety. The dispute resolution methods and person(s) may include any of the following:

(1) A single expert and/or hearing officer qualified in the field that is the subject of the Claim;

(2) An expert panel, consisting of members that are qualified in a field that is the subject of the Claim;

(3) An arbitration process which may be binding if agreed to by the parties to the Claim;

(4) A mediator; or

(5) Any other method that best accomplishes the purposes set forth in Rule R23-26-1.

7.8.8 THE EVALUATION PROCESS, TIMEFRAMES OF EVALUATOR(S), DIRECTOR'S DETERMINATION, ADMINISTRATIVE APPEAL TO THE EXECUTIVE DIRECTOR AND JUDICIAL REVIEW. The Claim shall be evaluated, the timeframe for specific events related to the person(s) evaluating the Claim, the Director's determination, any appeal to the Executive Director and any judicial review shall be subject to the provisions of Rule R23-26-5(8), R23-26-5(9), R23-26-6 and R23-26-8. A copy of these Administrative Rules are available at DFCM.

7.8.9 APPEAL PROCESS PREREQUISITE FOR FURTHER CONSIDERATION OR JUDICIAL REVIEW. The administrative appeal to the Executive Director is a prerequisite for any further consideration by the State of Utah, or to judicial review of the issue giving rise to the Claim. It shall be considered that the Contractor, or another party brought into the process by the DFCM, has not exhausted its administrative remedies if such an administrative appeal is not undertaken.

7.9 PAYMENT OF CLAIM.

7.9.1 When a stand alone component of a Claim has received a final determination, and is no longer subject to review or appeal, that amount shall be paid in accordance with the payment provisions of the Contract Documents or judicial order.

7.9.2 When the entire Claim has received a final determination, and is no longer subject to review or appeal, the full amount shall be paid within fourteen (14) days of the date of the final determination unless the work or services has not been completed, in which case the amount shall be paid in accordance with the payment provisions of the Contract Documents to the point that the work or services is completed.

7.9.3 The final determination date is the earlier of the date upon which the claimant accepted the settlement in writing with an executed customary release document and waived its rights of appeal, or the expiration of the appeal period, with no appeal filed, or the determination made resulting from the final appeal.

7.9.4 Any final determination where the Division is to pay additional monies to the Contractor shall not be delayed by any appeal or request for judicial review by another party brought into the process by the Division as being liable to the DFCM.

7.9.5 Notwithstanding any other provision of the Contract Documents, payment of all or part of a Claim is subject to any set-off, claims or counterclaims of the DFCM.

7.9.6 Payment to the Contractor for a Subcontractor issue (Claim) deemed filed by the Contractor, shall be paid by the Contractor to the Subcontractor in accordance with the contract between the Contractor and the Subcontractor.

7.9.7 The execution of a customary release document related to any payment may be required as a condition of making the payment.

7.10 ALLOCATION OF COSTS OF CLAIM RESOLUTION PROCESS.

7.10.1 In order to file a Claim, a claimant must pay a $1500 filing fee to the DFCM. When the Claim is a pass-through from a Subcontractor in accordance with Paragraph 7.7.5, the payment of the fee shall be made by the Subcontractor.

7.10.2 Unless otherwise agreed to by the parties to the Claim, the costs of resolving the Claim shall be allocated among the parties on the same proportionate basis as the determination of financial responsibility for the Claim.

7.10.3 The costs of resolving the Claim that are subject to allocation include the claimant's filing fee, the costs of any person(s) evaluating the Claim, the costs of making any required record of the process, and any additional testing or inspection procured to investigate and/or evaluate the Claim.

7.10.4 Each party is responsible for its own attorney fees.

7.11 ALTERNATIVE PROCEDURES. To the extent otherwise permitted by law, if all parties to a Claim agree in writing, a protocol for resolving a Claim may be used that differs from the process described in this Article 7.

7.12 IMPACT ON FUTURE SELECTIONS.

7.12.1 The presentation of a good faith and non-frivolous issue or Claim shall not be considered by the DFCM's selection process for a future award of contract; and

7.12.2 The submission of a bad faith and frivolous issue or Claim, or the failure by a Contractor to facilitate resolution of a Claim, may be considered in the DFCM's evaluation of performance.

7.13 REPORT TO BUILDING BOARD. The DFCM may report on the claim to the Utah State Building Board.

7.14 DFCM'S RIGHT TO HAVE ISSUES, DISPUTES OR CLAIMS CONSIDERED. As stated in Rule R23-26-1(6), Articles 7.7 through 7.13 above do not limit the right of DFCM to have any of its issues, disputes or claims considered. DFCM reserves all rights to pursue its issues, disputes or claims in law or equity including, but not limited to, any or all of the following: damages, delay damages and impacts, losses, liability, patent or latent defects, or failure to perform under the Contract Documents. If the Director appoints an expert or a panel to consider any such issue(s), dispute(s) or claim(s) of DFCM, the Contractor shall cooperate with such expert or panel process.

ARTICLE 8. PAYMENTS AND COMPLETION.

8.1 SCHEDULE OF VALUES. With the first Application for Payment, the Contractor shall submit to the A/E and the DFCM Representative a schedule of values allocated to all the various portions of the Work. The Schedule of Values shall be submitted on the form approved and provided by DFCM. The A/E shall make recommendations to the DFCM Representative regarding the Schedule of Values including any suggested modifications. When approved, including any approved modifications, by the DFCM Representative, it shall be the basis for future Contractor Applications for Payments. The Contractor shall not be entitled to payment until receipt and acceptance of the Schedule of Values.

8.2 APPLICATIONS FOR PAYMENT.

8.2.1 IN GENERAL. The following general requirements shall be met:

(1) The Contractor shall submit to the A/E an itemized Application for Payment for Work completed in accordance with the schedule of values and that reflects retainage as provided for in the Contractor's Agreement. The Application for Payment shall be on a special form approved and provided by DFCM.

(2) Such application shall be supported by such data substantiating the Contractor's right to payment as the DFCM or A/E may require. Said data may include, but is not limited to, copies of requisitions from Subcontractors.

(3) Such applications may include requests for payment pursuant to approved Change Orders or Construction Change Directives.

(4) Such applications may not include requests for payment for portions of the Work performed by a subcontractor when the Contractor does not intend to pay to a Subcontractor because of a dispute or other reason.

(5) In executing the Application for Payment, the Contractor shall attest that subcontractors involved with prior applications for payment have been paid, unless the Contractor provides a detailed explanation why such payment may not have occurred. DFCM reserves the right to require the Contractor to submit a payment waiver from one or more subcontractors.

8.2.2 PAYMENT FOR MATERIAL AND EQUIPMENT. Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment

delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the DFCM and A/E, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the DFCM to establish the DFCM's title to such materials and equipment or otherwise protect the DFCM's interest, and shall include applicable insurance, storage and transportation to the site for such materials and equipment stored off the site. The DFCM may require copies of invoices or other suitable documentation.

8.2.3 WARRANTY OF TITLE. The Contractor warrants that title to all Work covered by an Application for Payment will pass to the DFCM no later than the time for payment. The Contractor further warrants that upon submittal of an Application for Payment, all Work for which Certificates for Payment have been previously issued and payments received from the DFCM shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, or other persons or entities making a claim by reason of having provided labor, materials and/or equipment relating to the Work.

8.2.4 HOLDBACK BY DFCM. Notwithstanding anything to the contrary contained in the Contract Documents, the DFCM may, as a result of the claims resolution process, withhold any payment to the Contractor hereunder if and for so long as the Contractor fails to perform any of its obligations hereunder or otherwise is in default under any of the Contract Documents.

8.3 CERTIFICATES FOR PAYMENT.

8.3.1 ISSUED BY A/E. The A/E shall within ten (10) days after receipt of the Contractor's Application for Payment, either issue to the DFCM a Certificate for Payment, with a copy to the Contractor, for such amount as the A/E determines due, or notify the Contractor and DFCM in writing of the A/E's reasons for withholding certification in whole or in part as provided in Paragraph 8.4.1. If the A/E fails to act within said ten (10) day period, the Contractor may file the Application for Payment directly with the DFCM Representative and the DFCM will thereafter have twenty (20) days from the date of the DFCM's receipt to resolve the amount to be paid and to pay the undisputed amount. The accuracy of the Contractor's Applications for Payment shall be Contractor's responsibility, not A/E's.

8.3.2 A/E'S REPRESENTATIONS. The A/E's issuance of a Certificate for Payment shall constitute a representation to the DFCM that to the best of the A/E's knowledge, information and belief, based upon the A/E's observations at the site, the data comprising the Application for Payment, and what is reasonably inferable from the observations and data, that the Work has progressed to the point indicated in the Application and that the quality of the work is in accordance with the Contract Documents. The foregoing representations are subject to minor deviations from the Contract Documents correctable prior to completion and to specific qualifications expressed by the A/E. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment shall not be a representation that the A/E has (a) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (b) reviewed construction means, methods, techniques, sequences or procedures, (c) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the DFCM to substantiate the Contractor's right to payment, (d) ascertained how or for what purpose the Contractor used money previously paid on account of Contract Sum, or (e) any duty to make such inquiries.

8.4 DECISIONS TO WITHHOLD CERTIFICATION.

8.4.1 WHEN WITHHELD. The A/E may decide not to certify payment and may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the DFCM, if in the A/E's judgment the representations to the DFCM required in

Paragraph 8.3.2 above can not be made. If the A/E is unable to certify payment in the amount of the Application, the A/E shall notify the Contractor and DFCM as provided in Paragraph 8.3.1 above. If the Contractor and A/E can not agree on a revised amount, the A/E shall promptly issue a Certificate for Payment for the amount to which the A/E makes such representations to the DFCM. The A/E may also decide not to certify payment or, because of subsequently discovered evidence or observations, may nullify the whole or part of a Certificate for Payment previously issued, to such extent as may be necessary in the A/E's opinion to protect the DFCM from loss because of:

(1) Defective Work not remedied;

(2) Third party claims filed or reasonable evidence indicating probable filing of such claims;

(3) Failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;

(4) Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

(5) Damage to the DFCM or another contractor;

(6) Reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or

(7) Failure to carry out the Work in accordance with the Contract Documents.

8.4.2 CERTIFICATION ISSUED WHEN REASONS FOR WITHHOLDING REMOVED. When the reasons stated in Paragraph 8.4.1 for withholding certification are removed, certification will be made for such related amounts.

8.4.3 CONTINUE WORK EVEN IF CONTRACTOR DISPUTES A/E'S DETERMINATION. If the Contractor disputes any determination by the A/E or the result of the claims resolution process with regard to any Certification of Payment, the Contractor nevertheless shall expeditiously continue to prosecute the Work.

8.4.4 DFCM NOT IN BREACH. The DFCM shall not be deemed to be in breach of this Contract by reason of the withholding of any payment pursuant to any provision of the Contract Documents provided the DFCM's action or such withholding is consistent with the results of the dispute resolution process.

8.5 PROGRESS PAYMENTS.

8.5.1 IN GENERAL, INTEREST OR LATE PAYMENTS.

(1) Except as provided in Paragraph 8.3.1, the DFCM shall pay any undisputed amount within thirty (30) days of the date that the application for payment was submitted to the A/E. In no event shall DFCM be required to pay any disputed amount.

(2) Except as otherwise provided by law, if any payment is late based upon the provisions of the Contract Documents, the Contractor shall be paid interest in an amount equal to the published Wall Street Journal prime rate plus 2%. The published Wall Street Journal Prime Rate shall be determined using such rate that is published closest to the 1st of the month for each month of the late period. The amount of payment of interest shall be apportioned using such rate(s) for the late period.

8.5.2 CONTRACTOR AND SUBCONTRACTOR RESPONSIBILITY. The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the DFCM, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payment to its Subcontractors in a similar manner.

8.5.3 INFORMATION FURNISHED BY A/E OR DFCM TO SUBCONTRACTOR. The A/E or DFCM shall, on request, furnish to the Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the A/E and DFCM on account of portions of the Work done by such Subcontractor.

8.5.4 DFCM AND A/E NOT LIABLE. Neither the DFCM or A/E shall have an obligation to pay, monitor or enforce the payment of money to a Subcontractor, except to the extent as may otherwise be required by law.

8.5.5 CERTIFICATE, PAYMENT OR USE NOT ACCEPTANCE OF IMPROPER WORK. A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the DFCM shall not constitute acceptance of Work that is not in accordance with the Contract Documents.

8.6 PAYMENT UPON SUBSTANTIAL COMPLETION. Upon Substantial Completion of the Work or designated portion thereof and upon application by the Contractor and certification by the A/E, the DFCM shall make payment, reflecting adjustment in retainage, if any, for such Work or portion thereof as provided in the Contract Documents. To the extent allowed by law, the DFCM may retain up to 200% of the fair market value of the work that has not been completed in accordance with the Contract Documents.

8.7 PARTIAL OCCUPANCY OR USE.

8.7.1 IN GENERAL. The DFCM may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is Substantially Complete, provided the DFCM and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of the warranties required by the Contract Documents. When the Contractor considers a portion to be substantially complete, the Contractor shall prepare and submit a list to the A/E as previously provided for herein. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. Contractor shall have continuing responsibility to protect the site and the Work during such partial occupancy and shall be responsible for damage except to the extent caused solely by the DFCM during such partial occupancy or use.

The stage of progress of the Work shall be determined by written agreement between the DFCM and Contractor.

8.7.2 INSPECTION. Immediately prior to such partial occupancy or use, the DFCM, Contractor and A/E shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

8.7.3 NOT CONSTITUTE ACCEPTANCE. Except to the extent it is agreed upon in writing by the DFCM, partial occupancy or use of a portion or portion of the Work shall not constitute acceptance of Work not complying with the requirement of the Contract Documents.

8.8 FINAL PAYMENT.

8.8.1 CERTIFICATE FOR PAYMENT. The A/E's final Certificate for Payment shall constitute a further representation that the conditions listed in Paragraph 8.8.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

8.8.2 CONDITIONS FOR FINAL PAYMENT. Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the A/E the following to the extent required by the DFCM Representative:

(1) An affidavit that payrolls, bills for material and equipment, and other indebtedness connected with the Work for which the DFCM or the State of Utah's property might be responsible or encumbered (less amounts

withheld by DFCM) have been paid or otherwise satisfied;

(2) A current or additional certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days prior written notice, by certified mail, return receipt requested, has been given to the DFCM;

(3) A written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents;

(4) If requested by surety in a timely manner or by DFCM, consent of surety, to final payment;

(5) Receipt of Record Drawings, Specifications, Addenda, Change Orders and other Modifications maintained at the site; the warranties, instructions, operation and maintenance manuals, and training videos required to be furnished by the Contract Documents;

(6) Other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the DFCM. If a Subcontractor refuses to furnish a release or waiver required by the DFCM, the DFCM may require consent of Surety to the final payment. If such liens, claims, security interests or encumbrances remain unsatisfied after payments are made, the Contractor shall refund to the DFCM all money that the DFCM may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees; and

(7) A written statement demonstrating how the Contractor will distribute interest earned on retention to Subcontractors as required by Section 13.8.5, U.C.A.

8.8.3 WAIVER OF CLAIMS: FINAL PAYMENT. The making of final payment shall constitute a waiver of Claims by the-DFCM except those arising from:

(1) Liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;

(2) Failure of the Work to comply with the requirements of the Contract Documents;

(3) Terms of warranties required by the Contract Documents; or

(4) The one-year guaranty period and any corrected Work.

8.8.4 DELAYS NOT CONTRACTOR'S FAULT. If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, the DFCM shall, upon application by the Contractor and certification by the A/E, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims. Unless otherwise stated by the DFCM in writing, the making of final payment shall constitute a waiver of claims by the DFCM as provided in Paragraph 8.8.3 for that portion of that Work fully completed and accepted by the DFCM.

8.8.5 WAIVER BY ACCEPTING FINAL PAYMENT. Acceptance of final payment by the Contractor or a Subcontractor shall constitute a waiver of Claims by that payee except those Claims previously made in writing and identified by that payee as unsettled at the time of final Application for Payment. Such waivers shall be in addition to the waiver described in Paragraph 8.8.3.

ARTICLE 9. TESTS AND INSPECTIONS, SUBSTANTIAL AND FINAL COMPLETION, UNCOVERING, CORRECTION OF WORK AND GUARANTY PERIOD.

9.1 TESTS AND INSPECTIONS.

9.1.1 IN GENERAL. Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations, resolutions or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise specifically set forth in the Contract Documents or agreed to by the DFCM in writing, the DFCM shall contract for such tests, inspections and approvals with an independent entity, or with the appropriate public authority, and the DFCM shall bear all related costs of tests, inspections and approvals except as provided below. If any of the Work is required to be inspected or approved by the terms of the Contract Documents or by any public authority, the Contractor shall, at least two working days prior to the time of the desired inspection, and following the procedures established by the DFCM, request such inspection or approval to be performed. The Contractor shall give the A/E timely notice of when and where tests and inspections are to be made so that the A/E may observe such procedures.

9.1.2 FAILURE OF AN INSPECTOR TO APPEAR. Work shall not proceed without any required inspection and the associated authorization by DFCM to proceed unless the following procedures and requirements have been met:

(1) The inspection or approval was requested in a timely manner as provided in Paragraph 9.1.1;

(2) The Contractor received written confirmation from the inspection entity that the inspection was scheduled;

(3) The Contractor has contacted or attempted to contact the inspector to confirm that the inspector is unable to perform the inspection as scheduled;

(4) If the inspector has confirmed that it is unable to perform the inspection as scheduled or if the Contractor is unable to contact the inspector, the contractor shall attempt to contact the State Building Official or DFCM Representative for instruction; and

(5) The Contractor has documented the condition of the work prior to being covered through photos or other means.

9.1.3 NONCONFORMING WORK. If such procedures for testing, inspection or approval under Paragraph 9.1.1 reveal failure of portions of the Work to comply with the requirements established by the Contract Documents, the Contractor shall bear all costs made necessary by such failure including those of repeated procedures and compensation for the DFCM's expenses, including the cost of retesting for verification of compliance if necessary, until the DFCM accepts the Work in question as complying with the requirements of the Contract Documents.

9.1.4 CERTIFICATES. Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the A/E.

9.1.5 A/E OBSERVING. If the A/E is to observe tests, inspections or approvals required by the Contract Documents, the A/E shall do so with reasonable promptness and, where practicable, at the normal place of testing.

9.1.6 PROMPTNESS. Tests, inspections and arrangements for approvals conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

9.2 INSPECTIONS: SUBSTANTIAL AND FINAL.

9.2.1 SUBSTANTIAL COMPLETION INSPECTION. Prior to requesting a substantial completion inspection, the Contractor shall prepare a comprehensive initial punchlist, including unresolved items from prior inspections, for review by the DFCM and A/E to determine if the Project is ready for a substantial completion inspection. If the DFCM determines that the initial punchlist indicates that the Project is not substantially complete, the initial punchlist will be returned to the Contractor with written comments. If the DFCM determines that the initial punchlist indicates that the Project may be substantially complete, the A/E shall promptly organize and

perform a Substantial Completion inspection in the presence of the DFCM and all appropriate authorities.

(1) If the A/E reasonably determines that the initial punchlist prepared by the Contractor substantially understates the amount of the Work remaining to be completed and the Project is not substantially complete, the A/E shall report this promptly to the DFCM, and upon concurrence of the DFCM, the Contractor will be assessed the costs of the inspection and punchlist preparation incurred by the A/E and the DFCM.

(2) When the Work or designated portion thereof is Substantially Complete, the A/E shall prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion; shall establish responsibilities of the DFCM and Contractor for security, maintenance, heat, utilities, damage to the work and insurance; and shall fix the time within which the Contractor shall finish all items on the punchlist accompanying the Certificate. The Certificate of Substantial Completion shall require approval by the DFCM Representative. If there is a punchlist, the Contractor shall proceed promptly to complete and correct items on the list. Failure to include an item on the punchlist does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

(3) Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof except to the extent as provided otherwise in the Contract Documents or if such warranty is related to an item where the work is not complete. Such warranty documents shall state the length of the warranty, which must comply with the Contract Documents.

(4) The Certificate of Substantial Completion shall be submitted by the A/E to the DFCM and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.

(5) Except to the extent the DFCM Representative otherwise approves in advance and in writing, the Contractor shall submit the following documents in order to achieve Substantial Completion: written warranties, guarantees, operation and maintenance manuals, and all complete as-built drawings. The Contractor must also provide or obtain any required approvals for occupancy. The Contractor is responsible for the guaranty of all Work, whether performed by it or by its Subcontractors at any tier.

9.2.2 FINAL COMPLETION INSPECTION. Prior to requesting a final inspection, the Contractor shall verify all punchlist items are corrected/completed. Once all punchlist items are corrected/completed the Contractor shall notify the DFCM and request a final inspection. The DFCM shall notify the A/E and perform a final inspection. Two final inspections may be allowed due to required weather changes required to complete some items. When all punchlist items are completed a final pay request will be provided by the Contractor, authorized by the A/E and processed by the DFCM.

9.3 UNCOVERING OF WORK.

9.3.1 UNCOVER UNINSPECTED WORK. Except as provided in Paragraph 9.3.3, if a portion of the Work is covered prior to an Inspector's approval to proceed, it must, be uncovered for the Inspector's inspection and be replaced at the Contractor's expense without change in the Contract Time.

9.3.2 OBSERVATION PRIOR TO COVERING. Except as provided in Paragraph 9.3.3, if the DFCM or the A/E has requested in writing to observe conditions prior to any Work being covered or if such observation is specified in the Contract Documents, and the Work is covered without such observation, the Contractor shall be required to uncover and appropriately replace the Work at the Contractor's expense without change in the Contract Time. If the Contractor requests an inspection and the DFCM or A/E, including any inspector of each, does not appear, the Contractor shall immediately notify the DFCM of such lack of appearance, but shall not cover the Work without such inspection.

9.3.3 WHEN AN INSPECTOR FAILS TO APPEAR OR A/E OR DFCM DID NOT MAKE PRIOR REQUEST. If Work is performed by the Contractor without an inspection as provided in Paragraph 9.1.2 or if a portion of the Work has been covered which the A/E or DFCM has not specifically requested to observe prior to its being covered or such observation is not specified by the Contract Documents, the A/E or DFCM may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement, shall, by appropriate Change Order, be charged to the DFCM. If such Work is not in accordance with the Contract Documents, the Contractor shall pay such costs unless the condition was caused by the DFCM or a separate contractor in which event the DFCM shall be responsible for payment of such costs.

9.4 CORRECTION OF WORK AND GUARANTY PERIOD.

9.4.1 CONTRACTOR CORRECT THE WORK. The Contractor shall correct Work rejected by the A/E, Inspector or DFCM, or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear the costs of correcting such rejected Work, including additional testing and inspections and compensation for the A/E's and Inspector's services and expenses made necessary thereby.

9.4.2 GUARANTY AND CORRECTION AFTER SUBSTANTIAL COMPLETION. If within one year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Paragraph 9.2.1 or by terms of an applicable special warranty or guaranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, including failure to perform for its intended purpose, the Contractor shall correct it promptly after receipt of written notice from the DFCM to do so unless the DFCM has previously given the Contractor a written acceptance of such condition. The period of one year shall be extended with respect to portions of the Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work. This obligation of the Contractor under this Paragraph 9.4.2 shall be operative notwithstanding the acceptance of the Work under the Contract, the final certificate of payment, partial or total occupancy and/or termination of the Contract. The DFCM shall give notice of observed defects with reasonable promptness, however, failure to give such notice shall not relieve the Contractor of its obligation to correct the Work at the cost that the Contractor would have incurred if the DFCM did so report with reasonable promptness. All corrected Work shall be subject to a one-year guaranty period the same in all respects as the original Work, except that such guaranty period shall commence from the time of Substantial Completion of the corrected Work. This guaranty period does not affect the DFCM's right to pursue any available remedies against Contractor.

9.4.3 REMOVAL OF WORK.

(1) The Contractor shall promptly remove from the premises all Work that the DFCM and/or the A/E determines as being in nonconformance with the Contract Documents, whether incorporated or not.

(2) The Contractor shall promptly replace and re-execute the Work in accordance with the Contract Documents and without expense to the DFCM.

(3) The Contractor shall bear the expense of correcting destroyed or damaged construction, whether completed or partially completed, of the DFCM or of other contractors destroyed or damaged by such removal or replacement.

(4) If the Contractor does not remove such rejected Work within a reasonable time, fixed by written notice, the DFCM may have the materials removed and stored at the expense of the Contractor.

(5) If the Contractor does not correct the nonconforming Work within a

reasonable time, fixed by written notice, the DFCM may correct it in accordance with Paragraph 12.2.2 of these General Conditions.

9.4.4 NOT LIMIT OTHER OBLIGATIONS. Nothing contained in this Article 9.4 shall be construed to establish a period of limitation with respect to other obligations which the Contractor may have under the Contract Documents. Establishment of the time period of one year as described in Paragraph 9.4.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

9.5 ADDITIONAL WARRANTIES.

9.5.1 IN GENERAL. In addition to any other provisions of this Article 9, the following warranties shall apply:

(1) The Contractor warrants to the DFCM that materials and equipment furnished under the Contract will be of good quality and new, except to the extent otherwise required or expressly permitted by the Contract Documents.

(2) The Contractor also warrants to the DFCM that the Work will be free from defects not inherent in the quality required or permitted and that the Work will conform with the requirements of the Contract Documents. Work not conforming to said requirements, including substitutions not properly approved and authorized, may be considered defective at the DFCM's option.

9.5.2 EXCLUSION. Unless due to the negligent or intentional act or omission of the Contractor or those under the Contractor's control, or as otherwise stated in the Contract Documents, the Contractor's guaranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

9.5.3 FURNISH EVIDENCE ON REQUEST. If requested by the A/E or DFCM, the Contractor shall furnish satisfactory evidence as to the type and quality of materials and equipment.

9.6 **ACCEPTANCE OF NONCONFORMING WORK**. If the DFCM prefers to accept Work which is not in accordance with the requirements of the Contract Documents, the DFCM may do so in writing instead of requiring its removal and correction, in which case the Contract Sum shall be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 10. INSURANCE AND BONDS.

10.1 LIABILITY INSURANCE.

10.1.1 IN GENERAL. To protect against liability, loss and/or expense arising from damage to property or injury or death of any person or persons incurred in any way out of, in connection with or resulting from the Work provided hereunder, Contractor shall obtain and maintain in force during the entire period of this Contract without interruption, at its own expense, the following insurance from insurance companies authorized to do business in the State of Utah in a form and content satisfactory to the DFCM and rated "A-"or better with a financial size category of (a) Class X or larger where the Contract Sum is $1,000,000 or greater or (b) Class VII or larger where the Contract Sum is under $1,000,000. Said rating and financial size category shall be as published by A.M. Best Company at the time the Contract is executed.

(1) Workers' Compensation Insurance and Employers' Liability Insurance. Worker's Compensation Insurance shall cover full liability under the Worker's Compensation Laws of the jurisdiction in which the Project is located at the statutory limits required by said jurisdiction's laws. Employer's Liability Insurance shall provide the following limits of liability: $100,000 for each accident; $500,000 for Disease-Policy Limit; and $100,000 for Disease-Each Employee. The Contractor shall require all Subcontractors to take

and maintain similar policies of Workers' Compensation Insurance.

(2) Commercial General Liability Insurance.

a. Commercial General Liability Insurance, on an "occurrence basis," including insurance for operations, independent contractors, subcontractors at any tier, products/completed operations and contractual liability specifically designating the Indemnity provisions of these General Conditions as an insured contract on the Certificate of Insurance. Such Commercial General Liability Insurance must be endorsed with a Broad Form Property Damage Endorsement (including Completed Operations) and afford coverage for explosion, collapse and underground hazards. Such Commercial General Liability Insurance shall be in limits not less than the following:

$2,000,000 General Aggregate, plus:

i.. If the Construction Value is $25,000,000 or more, an additional $5,000,000 umbrella policy (which covers aggregate and per occurrence) is required; or

ii. if the Construction Value is $10,000,000 or more but less than $25,000,000, an additional $2,000,000 umbrella policy (which covers aggregate and per occurrence) is required.

$1,000,000	Products-Completed Operations Aggregate
$1,000,000	Personal and Advertising Injury
$1,000,000	Each Occurrence

b. For purposes of this subparagraph 2(a), Construction Value means:

i. the Contract Sum if the work is being performed under a Standard Construction Contractor's Agreement;

ii. the Fixed Limit of Construction Costs if the work is being performed under a Construction Manager/General Contractor Agreement; or

iii. the Guaranteed Fixed contract Amount if the work is to be performed under a Design/Build Agreement.

(3) Automobile liability insurance for claims arising from the ownership, maintenance, or use of a motor vehicle. The insurance shall cover all owned, non-owned, and hired automobiles used in connection with the Work, with the following minimum limits of liability:

$1,000,000 Combined Single Limit Bodily Injury and Property Damage Per Occurrence

(4) Aircraft Use. Contractor using its own aircraft, or employing aircraft in connection with the Work performed under this Agreement shall maintain Aircraft Liability Insurance with a combined single limit of not less than $1,000,000 per occurrence. Said certificate shall state that the policy required by this paragraph has been endorsed to name the State of Utah as Additional Insureds.

(5) Unless otherwise provided by the procurement documents, the insurance requirements in 10.1.1(1) through (4) above do not apply to subcontractors or suppliers at any tier under the Contractor and any insurance requirements of subcontractors and suppliers at any tier is a matter between the General Contractor and such subcontractor or supplier.

10.1.2 CONFIGURATIONS. Any policy required by this Article may be arranged under a single policy for the full limit required, or by a combination of underlying policies with the balance provided by an Excess or Umbrella Liability Policy.

10.1.3 CONTRACTOR LIABILITY. Irrespective of the requirements as to insurance to be carried by Contractor as provided herein; insolvency, bankruptcy or failure of any insurance company to pay all claims accruing, shall not be held to relieve Contractor of any obligations hereunder.

10.1.4 CERTIFICATE, NOTICE REQUIREMENTS, ADDITIONAL INSURED. Before the Contract Agreement is executed,

certificates evidencing coverages as specified above are in effect, shall be furnished to the DFCM. Such insurance certificates shall contain provisions that no cancellation, material change therein or non-renewal shall become effective except upon thirty (30) days prior written notice to the DFCM as evidenced by return receipt, certified mail sent to DFCM. The Contractor shall notify the DFCM within thirty (30) days of any claims(s) against the Contractor, and if such claim(s) exceed 20% of the applicable required insured limits, the DFCM may require the Contractor to re-instate the policy to provide full protection at the original limits. For any risk not covered by the Worker's Compensation Policy, the State of Utah shall be named as additional insured parties. All insurance policies provided shall be primary and non-contributing with, and not in excess of, any other insurance or self-insurance available to the State of Utah.

10.1.5 DEDUCTIBLE LIABILITY. Any and all deductibles in the above described policies shall be assumed by, for the account of, and at sole risk of Contractor. The allowable deductible for any of the policies required by these General Conditions shall be no more than $1,000 or 0.1 percent of the Contract Amount, whichever is greater. When there is an FLCC, the FLCC shall be the Contract Amount for purposes of calculating the allowable deductible.

10.1.6 ADDITIONAL REQUIREMENTS:

(1) Any type of insurance or any increase of limits of liability not described in this Agreement which the Contractor requires for its own protection or on account of any statute, rule or regulation, shall be its own responsibility and at its own expense.

(2) The carrying of any insurance required by this Agreement shall in no way be interpreted as relieving the Contractor or Subcontractors of any other responsibility or liability under this Agreement or any applicable law, statute, rule, regulation or order.

(3) Contractor shall not violate or knowingly permit to be violated any of the provisions of the policies on insurance required under these General Conditions.

10.2 "BUILDER'S RISK" PROPERTY INSURANCE.

10.2.1 IN GENERAL. The State shall provide "Builder's Risk" property insurance to protect the State, as well as all Contractors and Subcontractors, and include them as insureds, with respect to Work performed hereunder at the State's own cost and expense, according to the policies and forms currently in force with insurance carriers selected by the State's Risk Manager or issued by the State of Utah Risk Management Fund. The State of Utah's Risk Manager shall furnish, upon request, all parties in interest with copies of said policies authenticated by authorized agents of the insurers or the State of Utah's Risk Management Fund.

10.2.2 INSPECTIONS, RECOMMENDATIONS. DFCM, the Division of Risk Management and the Builder's Risk insurers shall have the right to inspect the Work. The Contractor shall comply with reasonable risk control recommendations made by insurers or the Division of Risk Management. Such inspections or recommendations do not relieve the Contractor of any of its responsibilities under the Contract Documents.

10.2.3 DEDUCTIBLE. The above described "Builders Risk" policies shall be subject to a total deductible of $5,000 per loss occurrence, which shall be assumed by all Contractors or Subcontractors, in proportion to their share of the total amount of an insured loss occurrence.

10.2.4 ADJUSTED WITH AND PAYABLE TO RISK MANAGER AS TRUSTEE. Any insured property loss is to be adjusted with the State of Utah Risk Manager, and made payable to the State of Utah Risk Manager as trustee for the Contractor and Subcontractors, as their interests may appear, subject to the requirements of any applicable loss payable clause.

10.2.5 WAIVER. Contractor, including all Subcontractors, and DFCM hereby waive all rights against each other for damages caused by

perils insured against under the "Builder's Risk" insurance provided by DFCM, except such rights as Contractor may have to the proceeds of such insurance held by the State of Utah's Risk Manager as trustee. The DFCM and the Contractor each shall require similar waivers from their contractors, subcontractors, subconsultants and agents, at any tier.

10.2.6 SPECIAL HAZARDS. DFCM shall bear the risk of loss, delay and/or damage due to earthquake and/or flood and may either insure or self-insure that risk. If the Contractor requests in writing that insurance for other special hazards be included in the "Builder's Risk" policy, the State of Utah's Risk Manager shall, if possible, include such insurance in the policy and the cost thereof shall be charged to the Contractor by Change Order.

10.3 PERFORMANCE BOND AND PAYMENT BOND. The Contractor shall submit and maintain in full force and effect as required by law and the Contract Documents, at its own expense, on forms provided by the Division of Facilities Construction and Management, and include as part of the quoted total all costs involved in securing and furnishing, the bonds listed below, based on the completed cost of the Contract and effective upon execution of the Contract. Said bonds shall be from surety companies which are authorized to do business in the State of Utah, listed in the U. S. Department of Treasury Circular 570, Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies, and acting within the limitation listed therein.

10.3.1 A full 100 percent performance bond covering the faithful execution of the Contract in accordance with the Contract Documents; and

10.3.2 A full 100 percent payment bond covering payment of all obligations arising under the Contract Documents, for the protection of each person supplying labor, service, equipment, or material for the performance of the Work.

10.3.3 Any required insurance required under the U.S. Terrorism Risk Insurance Act of 2002, any similar applicable law, or as such Act may be amended.

ARTICLE 11. MISCELLANEOUS PROVISIONS.

11.1 A/E'S RESPONSIBILITIES.
These General Conditions are not intended to provide an exhaustive or complete list of the A/E's responsibilities. A separate agreement between the DFCM and A/E incorporates these General Conditions by reference and includes additional Design responsibilities.

11.2 SUCCESSORS AND ASSIGNS. The DFCM and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. The Contractor shall not assign the Contract without the prior written consent of the DFCM, nor shall the Contractor assign any amount due or to become due as well as any rights under the Contract, without prior written consent of the DFCM.

11.3 WRITTEN NOTICE.

11.3.1 PERSONAL DELIVERY AND REGISTERED OR CERTIFIED MAIL. Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail, return receipt requested, to the last business address known to the party giving notice.

11.3.2 FAX. Notwithstanding any other provision of these General Conditions, written notice shall also be deemed to have been duly served by verified use of a FAX system by using the known and operative calling number. Service by use of the FAX system is encouraged when timely notice will benefit the–DFCM, A/E or Contractor. Notice shall be considered complete and verified upon the sending and confirmation of delivery using the FAX system, if on the same day notice is also sent by registered or certified mail,

return receipt requested, to the last business address known to the party giving notice, confirming the FAX delivery.

11.4 RIGHTS AND REMEDIES.

11.4.1 NOT LIMIT. Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

11.4.2 NOT WAIVER. Except as expressly provided elsewhere in the Contract Documents, no action or failure to act by the DFCM, A/E or Contractor shall constitute a waiver of a right or duty afforded them under the Contract Documents, nor shall such action or failure to act constitute approval or acquiescence in a breach thereunder, except as any of the above may be specifically agreed to in writing. In no case shall the Contractor or any Subcontractors be entitled to rely upon any waiver of any of these General Conditions unless agreed to in writing by the DFCM.

11.5 COMMENCEMENT OF STATUTORY LIMITATION PERIOD.

11.5.1 BEFORE SUBSTANTIAL COMPLETION. Except as provided in 11.5.4 below, as to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion.

12.5.2 BETWEEN SUBSTANTIAL COMPLETION AND FINAL CERTIFICATION FOR PAYMENT. Except as provided in Paragraph 11.5.4 below, as to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certification for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certification for Payment.

11.5.3 AFTER FINAL CERTIFICATION FOR PAYMENT. Except as provided in Paragraph 11.5.4 below, as to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any guaranty provided under Article 9 the date of any correction of the Work or failure to correct the Work by the Contractor under Paragraph 9.4.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or DFCM, whichever occurs last.

11.5.4 EXCEPTION. Notwithstanding any other provision of this Article 11.5 to the contrary, no applicable statute of limitations shall be deemed to have commenced with respect to any portion of the Work which is not in accordance with the requirements of the Contract Documents, which would not be visible or apparent upon conducting a reasonable investigation, and which is not discovered by the DFCM until after the date which, but for this Paragraph 11.5.4, would be the date of commencement of the applicable statute of limitations; the applicable statute of limitations instead shall be deemed to have commenced on the date of such discovery by the DFCM.

11.6 NOT DISCRIMINATE, NO SEXUAL HARASSMENT. Pursuant to the laws of the State of Utah, the Contractor, Subcontractors, or anyone for whose act any of them may be liable, will take affirmative action to not discriminate against any employee or applicant for employment because of race, creed, color, sex, religion, ancestry or national origin. To the extent applicable, said persons will comply with all provisions of Executive Order No. 11246 dated September 24, 1965 and rules, regulations, orders, instructions, designations and other directives promulgated pursuant thereto. Contractor, Subcontractors, or anyone for whose act any of them may be liable, shall not act in any manner as would violate the laws, regulations and policies of the United States or the State of Utah prohibiting sexual harassment.

11.7 APPLICABLE LAWS. The applicable laws and regulations of the State of Utah, as well as any applicable local laws and regulations not superseded or exempted by State law, shall govern the execution of the Work embodied in the Contract Documents as well as the interpretation of the Contract Documents.

11.8 INTERPRETATION. In the interest of brevity, the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an", but the fact that a modification or an article is absent from the statement and appears in another is not intended to affect the interpretation of either statement.

11.9 VENUE. In case of any dispute, which may arise under the Contract Documents, the place of venue shall be in the County of Salt Lake, Utah, unless otherwise agreed to by all the parties in writing.

11.10 SEVERABILITY. The invalidity of any part, paragraph, subparagraph, phase, provision or aspect of the Contract documents shall not impair or affect in any manner the validity, enforceability or effect of the remainder of the Contract Documents.

11.11 CONSTRUCTION OF WORDS. Unless otherwise stated in the Contract Documents, words, which have well-known technical or construction industry meanings, shall be construed as having such recognized meanings. Unless the context requires otherwise, all other technical words shall be construed in accordance with the meaning normally established by the particular, applicable profession or industry. All other words, unless the context requires otherwise, shall be construed with an ordinary, plain meaning.

11.12 NO THIRD PARTY RIGHTS. These General Conditions create rights and duties only as between DFCM and Contractor, and DFCM and A/E. Nothing contained herein shall be deemed as creating third party beneficiary contract rights or other actionable rights or duties as between Contractor and A/E, or as between DFCM, Contractor, or A/E on the one hand, and any other person or entity.

ARTICLE 12. TERMINATION OR SUSPENSION OF THE CONTRACT.

12.1 TERMINATION BY CONTRACTOR.

12.1.1 IN GENERAL. If the Work is stopped for a period of sixty (60) days through no act or fault of the Contractor or a Subcontractor, or their agents or employees or any other persons performing portions of the Work under contract with any of the above, the Contractor, may terminate the Contract in accordance with 12.1.2 hereinbelow for any of the following reasons:

(1) Because the DFCM has persistently failed to fulfill fundamental DFCM's obligations under the Contract Documents with respect to matters important to the progress of the Work;

(2) Issuance of an order of a court or other public authority having jurisdiction which necessitates such termination, except that where the Contractor has standing, the Contractor must cooperate in efforts to stay and/or appeal such order;

(3) An act of government, such as a declaration of national emergency, making material unavailable; or

(4) Unavoidable casualties or other similar causes as listed in Paragraph 12.2.2(2) hereinbelow.

12.1.2 NOTICE. If one of the reasons for termination in Paragraph 12.1.1 hereinabove exist, the Contractor may, upon ten (10) additional days' written notice to the DFCM and A/E, and such condition giving cause for termination still not cured, terminate the Contract and recover from the DFCM payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead, profit and damages associated only with work completed prior to the notice of termination.

12.2 TERMINATION BY THE DFCM FOR CAUSE.

12.2.1 IN GENERAL. The DFCM Director or Designee may terminate the Contract if the Contractor fails to cure any of the following within a period of ten (10) days (or longer if the DFCM so approves in writing) after receipt of notice from the DFCM specifying the cause for termination:

(1) The Contractor persistently or repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

(2) The Contractor fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

(3) The Contractor persistently disregards laws, ordinances, or rules, regulations, resolutions or orders of a public authority having jurisdiction; or

(4) The Contractor fails to perform the Work within the time specified in the Contract Documents or any authorized extension thereof or the Contractor fails to make progress with the Work as to endanger such compliance;

(5) The Contractor fails to perform the Work or is otherwise in breach of a material provision of the Contract Documents;

(6) The Contractor fails to respond promptly to the financial responsibility inquiry under the Contractor's Agreement;

(7) As permissible by law for a reason to terminate, the Contractor is adjudged bankrupt;

(8) As permissible by law for a reason to terminate, the Contractor should make a general assignment for the benefit to creditors;

(9) As permissible by law for a reason to terminate, the Contractor should have a receiver appointed on account of the Contractor's insolvency; or

(10) The Contractor fails to follow the material safety requirements and precautions either as expressly provided in the Contract Documents or as consistent with the customary practices in the industry.

12.2.2 DFCM'S RIGHT TO CARRY OUT THE WORK.

(1) If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten (10) day period (or longer if approved by the DFCM in writing) after receipt of written notice from the DFCM to cure such default or neglect, the DFCM may without prejudice to other remedies the DFCM may have, correct such deficiencies, including taking over the Work and prosecuting the same to completion, by contract or otherwise, and may take possession of, and utilize in completing the Work, such materials, appliances, and facilities as may be on the site of the Work as well as the site as necessary for its proper completion. In such case, the DFCM shall offset from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the A/E, DFCM's staff and legal counsel's additional services and expenses made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the DFCM. The Contractor shall continue performance of the Contract to the extent not terminated.

(2) Except with respect to defaults of Subcontractors, the Contractor shall not be liable for any excess costs if the failure to perform the Contract arises out of causes beyond the control and without the fault or negligence of the Contractor or anyone for whom the Contractor may be liable. Such causes may include, but are not limited to, acts of God or of the public enemy, acts of the State of Utah or federal government in either their sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and unusually severe weather; but in every case the failure to perform must be beyond the control and without the fault or negligence of the Contractor or anyone for whom the Contractor may be liable. If the failure to perform is caused by the default of a Subcontractor, and if such default arises out of causes beyond the control of both the Contractor

and the Subcontractor, and without the fault or negligence of either of them or anyone for whom either may be liable, the Contractor shall not be liable for any excess costs for failure to perform unless the supplies or services to be furnished by the Subcontractor were obtainable from other sources in sufficient time to permit the Contractor to meet the required delivery or completion schedule.

12.2.3 ITEMS REQUIRED TO BE TRANSFERRED OR DELIVERED. The DFCM may require the Contractor to transfer title and deliver to the DFCM, in the manner and to the extent directed by the DFCM:

(1) Any completed portion of the Work; and

(2) Any partially completed portion of the Work and any parts, tools, dies, jigs, fixtures, drawings, information, and contract rights (hereinafter called "construction materials") as the Contractor has specifically produced or specifically acquired for the performance of such part of this Contract as has been terminated; and the Contractor shall, upon direction of the DFCM, protect and preserve property in the possession of the Contractor in which the DFCM has an interest.

12.2.4 PAYMENT. When the DFCM terminates the Contract for one or more of the reasons stated in Paragraph 12.2.1, the DFCM may withhold payment and/or pursue all available remedies.

12.2.5 DFCM PROTECTION IF LIENABLE. When the subject property is lienable, the DFCM may withhold from amounts otherwise due the Contractor for such completed Work or construction materials such sum as the DFCM determines to be necessary to protect the State against loss because of outstanding liens or claims for former lien holders.

12.2.6 CREDITS AND DEFICITS. If the unpaid balance of the Contract Sum exceeds the full cost of finishing the Work, including compensation for the A/E's services and expenses made necessary thereby, such excess shall be paid to the Contractor. If such cost exceeds the unpaid balance, the Contractor shall pay the difference to the DFCM this obligation for payment shall survive the termination of the Contract.

12.2.7 IF CONTRACTOR FOUND NOT IN DEFAULT OR EXCUSABLE. If, after notice of termination of the Contract under the provisions of this Article, it is determined for any reason that the Contractor was not in default under the provisions of this Article, or that the default was excusable under the provisions of this Article, the rights and obligations of the parties shall be the same as if the notice of termination had been issued pursuant to the termination for convenience provisions.

12.2.8 RIGHTS AND REMEDIES NOT EXCLUSIVE. The rights and remedies of the DFCM provided in this Article 12.2 shall not be exclusive and are in addition to any other rights and remedies provided by law or under this Contract.

12.3 SUSPENSION, DELAY OR INTERRUPTION OF WORK BY THE DFCM FOR CONVENIENCE.

12.3.1 BY DFCM IN WRITING. The DFCM may in writing and without cause, order the Contractor to suspend, delay or interrupt the Work in whole or in part for such period of time as the DFCM may determine to be appropriate for the convenience of the DFCM.

12.3.2 TIME PERIOD FOR CLAIMS. Any PRE by the Contractor for adjustment under this Article 12.3 must be asserted by the Contractor, in writing, within twenty-one (21) days from the date of termination of such suspension, delay or interruption; provided that the DFCM may, in its sole discretion, receive and act upon any such PRE asserted at any time prior to final payment under this Contract.

12.3.3 ADJUSTMENTS. Any adjustment in Contract Sum and Time shall be in accordance with Articles 3, 4, and 7.

12.4 TERMINATION FOR CONVENIENCE OF THE DFCM.

12.4.1 IN GENERAL.

The performance of Work under this Contract may be terminated by the DFCM in accordance with this Article 12.4 in whole, or from time to time, in part, whenever the DFCM shall determine that such termination is in the best interest of the DFCM or any person for whom the DFCM is acting under this Contract. Any such termination shall be effected by delivery to the Contractor of a notice of termination specifying the extent to which performance of Work under the Contract is terminated, and the date upon which such termination becomes effective.

12.4.2 CONTRACTOR OBLIGATIONS. After receipt of a notice of termination, and except as otherwise directed by the DFCM in writing, the Contractor shall:

(1) Stop work under the Contract on the date and to the extent specified in the notice of termination;

(2) Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the Work under the Contract as is not terminated;

(3) Terminate all orders and subcontracts to the extent that they relate to performance of Work terminated by the notice of termination;

(4) Assign to the DFCM in the manner, at the times, and to the extent directed by the DFCM, all of the right, title and interest of the Contractor under the orders and subcontracts so terminated, in which case the DFCM shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;

(5) Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts, with the approval or ratification of the DFCM, which approval or ratification shall be final for all the purposes of this Article 12.4;

(6) Transfer title and deliver to the DFCM in the manner, at the times, and to the extent, if any, directed by the DFCM:

(a) The fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced as a part of, or acquired in connection with the performance of the Work terminated by the notice of termination; and

(b) The completed or partially completed drawings, information, and other property which, if the Contract had been completed, would have been required to be furnished to the DFCM;

(7) Use best efforts to sell, in the manner, at the times, to the extent, and at the price or prices directed or authorized by the DFCM, any property of the types referred to in Paragraph 12.4.2(6) above; provided, however, that the Contractor:

(a) Shall not be required to extend credit to any purchaser; and

(b) May acquire any such property under the conditions prescribed by and at a price or prices approved by the DFCM; and provided further that the proceeds of any such transfer of or disposition shall be applied in reduction of any payments to be made by the DFCM to the Contractor under this Contract or shall otherwise be credited to the price or cost of the Work covered by this Contract or paid in such other manner as the DFCM may direct;

(8) Complete performance of such part of the Work as shall not have been terminated by the notice of termination; and

(9) Take such action as may be necessary, or as the DFCM may direct, for the protection and preservation of the property related to this Contract which is in the possession of the Contractor in which the State has or may acquire an interest.

12.4.3 TERMINATION CLAIM. After receipt of a notice of termination, the Contractor may submit to the DFCM a PRE, in the form and with certification prescribed by the DFCM. Such PRE shall be submitted promptly

but in no event not later than sixty (60) days from the effective date of termination.

12.4.4 AGREED UPON PAYMENT. Subject to the provisions of Paragraph 12.4.3 above, the Contractor and the DFCM may agree upon the amount to be paid to the Contractor by reason of the total or partial termination of Work pursuant to this Article 12.4.

12.4.5 PAYMENT NOT AGREED UPON. In the event of the failure of the Contractor and the DFCM to agree, as provided in Paragraph 12.4.4, upon the whole amount to be paid to the Contractor by reason of the termination of Work pursuant to this Article 12.4, the DFCM shall pay to the Contractor the amounts determined by the DFCM as follows, but without duplication of any amounts agreed upon in accordance with Paragraph 12.4.4:

(1) With respect to all Contract Work performed prior to effective date of the notice of termination, the total (without duplication of any items) of:

(a) The cost of such Work including undisputed Claim amounts;

(b) The cost of terminating, settling and paying claims arising out of the termination of Work under subcontracts or orders as provided in Paragraph 12.4.2(5) above, exclusive of the amounts paid or payable on account of supplies or materials delivered or services furnished by Subcontractors prior to the effective date of the notice of termination under this Contract, which amounts shall be included in the cost on account of which payment is made under Paragraph 12.4.5(1)(a) above;

(c) A sum, as overhead and profit on Paragraph 12.4.5(1)(a) above, determined by the DFCM to be fair and reasonable;

(d) The reasonable cost of the preservation and protection of property incurred pursuant to Paragraph 12.4.2(9); and any other reasonable cost incidental to termination of Work under this Contract, including expenses incidental to the determination of the amount due to the Contractor as the result of the termination of Work under this Contract.

(2) The total sum to be paid to the Contractor under Paragraph 12.4.5(1) above shall not exceed the total Contract Sum as reduced by the amount of payments otherwise made and as further reduced by the Contract price of work not terminated. Except for normal spoilage, and except to the extent that the DFCM shall have otherwise expressly assumed the risk of loss in writing, there shall be excluded from the amounts payable to the Contractor under Paragraph 12.4.5(1) above, the fair value of property which is destroyed, lost, stolen, or damaged so as to become undeliverable to the DFCM, or to a buyer pursuant to Paragraph 12.4.2(7).

12.4.6 DEDUCTIONS. In arriving at the amount due the Contractor under this Article 12.4, there shall be deducted:

(1) All unliquidated advance or other payments on account theretofore made to the Contractor, applicable to the terminated portion of this Contract;

(2) Any Claim which the State may have against the Contractor in connection with this Contract; and

(3) The agreed price for, or the proceeds of sale of, any materials, supplies, or other things acquired by the Contractor or sold, pursuant to the provisions of this Article 13.4, and not otherwise recovered by or credited to the DFCM.

12.4.7 PARTIAL TERMINATION. If the termination is partial, the Contractor may file with the DFCM a PRE for the amounts specified in the Contract relating to the continued portion of the Contract and such equitable adjustment as may be agreed upon shall be made in such amounts. Any PRE under this Paragraph 12.4.7 must be filed within twenty-one (21) days from the effective date of the notice of termination.

12.4.8 PARTIAL PAYMENTS. The DFCM may, from time to time, under such terms and conditions as it may prescribe, make partial payments and payments on account against costs

incurred by the Contractor in connection with the terminated portion of this Contract whenever, in the opinion of the DFCM the aggregate of such payments shall be within the amount to which the Contractor will be entitled hereunder. If the total of such payments is in excess of the amount finally agreed or determined to be due under this Article 12.4, such excess shall be payable by the Contractor to the DFCM upon demand, together with interest at a rate equal to the average rate at the time being received from the investment of state funds, as determined by the State Treasurer, for the period until the date such excess is repaid to the DFCM; provided, however, that no interest shall be charged with respect to any such excess payment attributable to a reduction in the Contractor's claim by reason of retention or other disposition of termination inventory until ten (10) days after the date of such retention or disposition, or such later date as determined by the DFCM by reason of the circumstances.

12.4.9 PRESERVE AND MAKE AVAILABLE RECORDS. Unless otherwise provided for in this Contract, or by applicable law, the Contractor shall, from the effective date of termination until the expiration of three years after final settlement under this Contract, preserve and make available to the DFCM at all reasonable times at the office of the Contractor, but without direct charge to the DFCM, all books, records, documents and other evidence bearing on the costs and expenses of the Contractor under this Contract and relating to the Work terminated hereunder, or, to the extent approved by the DFCM Representative, photographs, micrographs, or other authentic reproductions thereof.

12.5 DFCM'S RIGHT TO STOP THE WORK. If the Contractor fails to correct Work or fails to carry our Work, as required by the Contract Documents or fails to comply with all required and customary safety precautions; the DFCM, by written order signed personally or by an agent specifically so empowered by the DFCM in writing, may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the DFCM to stop the Work shall not give rise to a duty on the part of the DFCM to exercise this right for the benefit of the Contractor or any other person or entity.

SECTION 012020 - PROGRESS MEETINGS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. To enable orderly review of progress during construction and to provide for systematic discussions of problems, the architect will conduct project meetings throughout the construction period.

B. In general, project meetings will be held at the job site in accordance with a mutually acceptable schedule.

C. The purpose of the project meetings is analysis of problems that might arise between the owner and the contractor relative to execution of the work.

1.3 RELATED SECTIONS

A. The Contractor's relations with his subcontractors and materials suppliers, and discussions relative thereto, are the Contractor's responsibility as described in the general conditions and are not part of project meetings content.

1.4 QUALITY ASSURANCE

A. Persons designated by the contractor to attend and participate in project meetings shall have all required authority to commit the contractor to solutions as agreed upon in the project meetings.

1.5 SUBMITTALS

A. Agenda Items: To the maximum extent possible, advise the architect at least twenty-four (24) hours in advance of the project meeting regarding all items to be added to the agenda.

B. Minimum Agenda

1. Review work progress since last meeting.

2. Note field observations, problems and decisions.

3. Identify issues which impede planned progress.

4. Review off-site fabrication issues.

5. Develop corrective measures and procedures to regain schedule.

6. Coordinate projected progress with other prime contractors.

7. Review submittal schedules, expedite as required to maintain schedule.

C. Minutes: The Contractor shall compile minutes of each project meeting and will distribute copies to the Owner and the Architect. Revisions to the minutes as necessary shall be made by the Architect. The Contractor shall make and distribute such other copies of minutes and revisions as he wishes.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

3.1 MEETING SCHEDULE

A. Coordinate with the architect as required to establish a mutually acceptable schedule for project meetings.

3.2 MEETING LOCATION

A. To the maximum extent practicable, project meetings shall be held at the job site. Provide adequate space and facility including table, chairs, and lighting for proper conduct of meeting.

3.3 ATTENDANCE

A. To the maximum extent practicable, assign the same person or persons to represent the contractor at project meetings throughout the construction period. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspects of the work are involved.

END OF SECTION

SECTION 012600 - MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Minor Changes in the Work: The Architect will issue instructions authorizing minor changes in the Work on DFCM Form.

B. Owner-Initiated Change Order Proposal Requests: The Architect will issue a description of proposed changes in the Work that require adjustment to the Contract Sum or Time. The description may include supplemental or revised Drawings and Specifications.

1. Proposal requests are for information only. Do not consider them an instruction to stop work or to execute the proposed change.

2. Within 3 days of receipt, submit an estimate of cost necessary to execute the change for the Owner's review.

a. Include an itemized list of products required and unit costs, with the total amount of purchases.
b. Indicate taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Indicate the effect the change will have on the Contract Time.

3. Contractor shall endeavor to solicit reasonable prices from Subcontractors for any additional work required.

C. Contractor-Initiated Proposals: When unforeseen conditions require modifications, the Contractor may submit a request for a change to the Architect.

1. Describe the proposed change. Indicate reasons for the change and the effect of the change on the Contract Sum and Time.

2. Include an itemized list of products required and unit costs, with the total amount of purchases.

3. Indicate taxes, delivery charges, equipment rental, and amounts of trade discounts.

D. Proposal Request Form: Use DFCM Document.

E. Allowance Adjustment: Base Change Order Proposals on the difference between the purchase amount and the allowance, multiplied by the measurement of work-in-place. Allow for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs only where indicated as part of the allowance.

2. Prepare explanations and documentation to substantiate margins claimed.

3. Submit substantiation of a change in work claimed in the Change Orders related to unit-cost allowances.

F. Submit claims for increased costs because of a change in the allowance, whether for purchase order amount or handling, labor, installation, overhead, and profit. Submit claims within 7 days of receipt of authorization to proceed. The Owner will reject claims submitted later than 14 days.

G. Construction Change Directive: When Owner and Contractor disagree on the terms of a Proposal Request, the Architect may issue a Construction Change Directive on DFCM Form instructing the Contractor to proceed with a change.

1. The Construction Change Directive contains a description of the change and designates the method to be followed to determine change in the Contract Sum or Time.

H. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completing the change, submit an itemized account and supporting data to substantiate Contract adjustments.

I. Change Order Procedures: Upon the Owner's approval of a Proposal Request, the Contractor will issue a Change Order on DFCM Form.

END OF SECTION

SECTION 013100 - COORDINATION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the project coordination as specified herein, including but not limited to, the following:

1. General project coordination procedures.

2. Conservation.

3. Coordination drawings.

4. Administrative and supervisory personnel.

5. Cleaning and protection.

1.3 RELATED SECTIONS

A. Project meeting - Section 012020.

B. Submittals - Section 013300.

C. Materials and equipment - Section 016000.

D. Closeout procedures - Section 017700.

1.4 COORDINATION

A. Coordinate construction operations included in various sections of these specifications to assure efficient and orderly installation of each part of the work. Coordinate construction operations included under different sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.

3. Make provisions to accommodate items scheduled for later installation.

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

1. Prepare similar memoranda for the owner and separate contractors where coordination of their work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the work. Such administrative activities include, but are not limited to, the following:

1. Preparation of schedules.

2. Installation and removal of temporary facilities.

3. Delivery and processing of submittals.

4. Progress meetings.

5. Project closeout activities.

D. Conservation: Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the work.

1.5 SUBMITTALS

A. Coordination Drawings: Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.

1. Show the relationship of components shown on separate shop drawings.

2. Indicate required installation sequences.

3. Comply with requirements contained in section "submittals".

B. Staff names: Within 15 days of commencement of construction operations, submit a list of the contractor's principal staff assignments, including the superintendent and other personnel in attendance at the project site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.

1. Post copies of the list in the project meeting room, the temporary field office, and each temporary telephone.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

3.1 GENERAL COORDINATION PROVISIONS

A. Inspection of conditions: Require the installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

3.2 CLEANING AND PROTECTION

A. Clean and protect construction in progress and adjoining materials in place, during handling and installation. Apply protective covering where required to assure protection from damage or deterioration at substantial completion.

B. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

C. Limiting exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Thermal shock.
5. Excessively high or low humidity.
6. Air contamination or pollution.
7. Water or ice.
8. Solvents.
9. Chemicals.
10. Light.
11. Radiation.
12. Puncture.

13. Abrasion.
14. Heavy traffic.
15. Soiling, staining, and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High-speed operation.
21. Improper lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft.
30. Vandalism.

END OF SECTION

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes administrative and procedural requirements for documenting the progress of construction during performance of the work, including but not limited to, the following:

1. Preliminary Construction Schedule.

2. Contractor's Construction Schedule.

3. Submittals Schedule.

4. Daily construction reports.

5. Material location reports.

6. Field condition reports.

7. Special reports.

8. Construction photographs.

1.3 RELATED SECTIONS

A. Coordination – Section 013100.

B. Progress meetings – Section 012020.

C. Submittals – Section 013300.

D. Closeout procedures – Section 017700.

1.4 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.

2. Predecessor activity is an activity that must be completed before a given activity can be started.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships.

Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.

1. Float time belongs to Owner.

2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.

3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

G. Major Area: A story of construction, a separate building, or a similar significant construction element.

H. Milestone: A key or critical point in time for reference or measurement.

I. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

1.5 SUBMITTALS

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

B. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.

2. Specification Section number and title.

3. Submittal category (action or informational).

4. Name of subcontractor.

5. Description of the Work covered.

6. Scheduled date for Architect's final release.

C. Preliminary Construction Schedule: Submit two printed copies; one a single sheet of reproducible media, and one a print.

D. Preliminary Network Diagram: Submit two printed copies; one a single sheet of reproducible media, and one a print; large enough to show entire network for entire construction period.

E. Contractor's Construction Schedule: Submit two printed copies of initial schedule, one a reproducible print and one a blue- or black-line print, large enough to show entire schedule for entire construction period.

1. Submit an electronic copy of schedule, and labeled to comply with requirements for submittals. Include type of schedule Initial or Updated and date on label.

F. CPM Reports: Concurrent with CPM schedule, submit three printed copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.

2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.

3. Total Float Report: List of all activities sorted in ascending order of total float.

4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.

G. Construction Photographs: Submit two prints of each photographic view within seven days of taking photographs.

1. Format: 8-by-10-inch smooth-surface matte prints on single-weight commercial-grade stock, mounted on linen or card stock to allow a 1-inch wide margin and enclosed back to back in clear plastic sleeves that are punched for standard 3-ring binder.

2. Identification: On back of each print, provide an applied label or rubber stamped impression with the following information:

   a. Name of Project.
   b. Name and address of photographer.
   c. Name of Architect.
   d. Name of Contractor.
   e. Date photograph was taken.
   f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

3. Negatives: Submit a complete set of photographic negatives in protective envelopes with each submittal of prints as a Project Record Document. Identify date photographs were taken.

H. Daily Construction Reports: Submit two copies at weekly intervals.

I. Material Location Reports: Submit two copies at monthly intervals.

J. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

K. Special Reports: Submit two copies at time of unusual event.

1.6 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting.

B. Photographer Qualifications: An individual of established reputation who has been regularly engaged as a professional photographer for not less than three years.

C. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to the Preliminary Construction Schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.

2. Verify availability of qualified personnel needed to develop and update schedule.

3. Discuss constraints, including work stages, area separations, interim milestones, and partial Owner occupancy.

4. Review delivery dates for Owner-furnished products.

5. Review schedule for work of Owner's separate contracts.

6. Review time required for review of submittals and resubmittals.

7. Review requirements for tests and inspections by independent testing and inspecting agencies.

8. Review time required for completion and startup procedures.

9. Review and finalize list of construction activities to be included in schedule.

10. Review submittal requirements and procedures.

11. Review procedures for updating schedule.

1.7 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

C. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities including temporary lighting.

PART 2 PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.

2. Initial Submittal: Submit concurrently with preliminary network diagram. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for commencement of the Work to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.

2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.

4. Startup and Testing Time: Include not less than 10 days for startup and testing.

5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.

2. Work under More Than One Contract: Include a separate activity for each contract.

3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.

4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date. Delivery dates indicated stipulate the earliest possible delivery date.

5. Work Restrictions: Show the effect of the following items on the schedule:

   a. Coordination with existing construction.
   b. Limitations of continued occupancies.
   c. Uninterruptible services.
   d. Partial occupancy before Substantial Completion.
   e. Use of premises restrictions.
   f. Provisions for future construction.
   g. Seasonal variations.
   h. Environmental control.

6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Startup and placement into final use and operation.

7. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    a. Structural completion.
    b. Permanent space enclosure.
    c. Completion of mechanical installation.
    d. Completion of electrical installation.
    e. Substantial Completion.

E. Milestones: Include milestones indicated in the schedule.

F. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.

G. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

H. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.

2.3 PRELIMINARY CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within seven days of date established for commencement of the Work.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Preliminary Network Diagram: Submit diagram within 14 days of date established for commencement of the Work. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's Construction Schedule using a CPM network analysis diagram.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for commencement of the Work.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.

3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.

4. Use "one workday" as the unit of time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

a. Preparation and processing of submittals.
b. Purchase of materials.
c. Delivery.
d. Fabrication.
e. Installation.

2. Processing: Process data to produce output data or a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.

3. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

a. Sub-networks on separate sheets are permissible for activities clearly off the critical path.

E. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.

2. Description of activity.

3. Principal events of activity.

4. Immediate preceding and succeeding activities.

5. Early and late start dates.

6. Early and late finish dates.

7. Activity duration in workdays.

8. Total float or slack time.

9. Average size of workforce.

10. Dollar value of activity (coordinated with the Schedule of Values).

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.

2. Changes in early and late start dates.

3. Changes in early and late finish dates.

4. Changes in activity duration's in workdays.

5. Changes in the critical path.

6. Changes in total float or slack time.

7. Changes in the Contract Time.

G. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.

2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.

3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.

4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.

    a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
    b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.5 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. High and low temperatures and general weather conditions.
5. Accidents.
6. Meetings and significant decisions.
7. Unusual events (refer to special reports).
8. Stoppages, delays, shortages, and losses.
9. Meter readings and similar recordings.
10. Emergency procedures.
11. Orders and requests of authorities having jurisdiction.
12. Change Orders received and implemented.
13. Construction Change Directives received.
14. Services connected and disconnected.
15. Equipment or system tests and startups.
16. Partial Completions and occupancies.
17. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a

request for information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.6 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, duration's, actual starts and finishes, and activity duration's.

3. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.

2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

3.2 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a photographer to take construction photographs.

B. Photographic Film: Medium-format, 2-1/4 by 2-3/4 inches.

C. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.

D. Preconstruction Photographs: Before starting construction, take four color photographs of Project site and surrounding properties from different vantage points, as directed by Architect. Show existing conditions adjacent to property.

E. Periodic Construction Photographs: Take color photographs monthly, coinciding with cutoff date associated with each Application for Payment. Photographer shall select vantage points to best show status of construction and progress since last photographs were taken.

1. Field Office Prints: Retain one set of prints of periodic photographs in field office at Project site, available at all times for reference. Identify photographs the same as for those submitted to Architect.

END OF SECTION

SECTION 013301 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.

2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.

3. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.

4. Division 1 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.

5. Division 1 Section "Closeout Procedures" for submitting warranties.

6. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

7. Division 1 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.

8. Division 1 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of Owner's personnel.

9. Divisions 2 through 16 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

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

B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

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

C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow 15 days for review of each resubmittal.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.

2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.

3. Include the following information on label for processing and recording action taken:

a. Project name.
b. Date.
c. Name and address of Architect.
d. Name and address of Contractor.
e. Name and address of subcontractor.
f. Name and address of supplier.

g. Name of manufacturer.
h. Submittal number or other unique identifier, including revision identifier.
   1). Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).
i. Number and title of appropriate Specification Section.
j. Drawing number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Other necessary identification.

F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.

1. Transmittal Form: Use AIA Document G810.

2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.

2. Note date and content of revision in label or title block and clearly indicate extent of revision.

3. Resubmit submittals until they are marked "REVIEWED."

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals with mark indicating "REVIEWED" taken by Architect.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

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

1. Submit electronic submittals directly to extranet specifically established for Project.

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

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.

3. Include the following information, as applicable:

    a. Manufacturer's written recommendations.
    b. Manufacturer's product specifications.
    c. Manufacturer's installation instructions.
    d. Standard color charts.
    e. Manufacturer's catalog cuts.
    f. Wiring diagrams showing factory-installed wiring.
    g. Printed performance curves.
    h. Operational range diagrams.
    i. Mill reports.
    j. Standard product operation and maintenance manuals.
    k. Compliance with specified referenced standards.
    l. Testing by recognized testing agency.
    m. Application of testing agency labels and seals.
    n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples.

5. Number of Copies: Submit three copies of Product Data, unless otherwise indicated. Architect will return two copies. Mark up and retain one returned copy as a Project Record Document.

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

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Dimensions.
    b. Identification of products.
    c. Fabrication and installation drawings.
    d. Roughing-in and setting diagrams.
    e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    f. Shopwork manufacturing instructions.
    g. Templates and patterns.
    h. Schedules.
    i. Design calculations.
    j. Compliance with specified standards.
    k. Notation of coordination requirements.
    l. Notation of dimensions established by field measurement.
    m. Relationship to adjoining construction clearly indicated.
    n. Seal and signature of professional engineer if specified.
    o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).

3. Number of Copies: Submit three opaque copies of each submittal, unless copies are required for operation and maintenance manuals. Submit five copies where copies are required for operation and maintenance manuals. Architect will retain two copies; remainder will be returned.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of appropriate Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three sets of Samples. Architect will retain one Sample sets; remainder will be returned.

1). Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

2). If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product.

2. Number and name of room or space.

3. Location within room or space.

4. Number of Copies: Submit three copies of product schedule or list, unless otherwise indicated. Architect will return two copies.

a. Mark up and retain one returned copy as a Project Record Document.

F. Submittals Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

G. Application for Payment: Comply with requirements specified in Division 1 Section "Payment Procedures."

H. Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."

I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.

2. Number and title of related Specification Section(s) covered by subcontract.

3. Drawing number and detail references, as appropriate, covered by subcontract.

4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Architect will return two copies.

a. Mark up and retain one returned copy as a Project Record Document.

J. LEED Submittals: Comply with requirements specified in Division 1 Section "LEED Requirements."

1. Number of Copies: Submit three copies of LEED submittals, unless otherwise indicated.

K. Material Safety Data Sheets (MSDSs) for LEED Certification: Submit information necessary to show compliance with LEED certification requirements, which will be the limit of the Architect's review.

1. Architect will not review non-LEED submittals that include MSDSs and will return the entire submittal for resubmittal.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.

2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

3. Test and Inspection Reports: Comply with requirements specified in Division 1 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."

C. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

J. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

K. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.

2. Date of evaluation.

3. Time period when report is in effect.

4. Product and manufacturers' names.

5. Description of product.

6. Test procedures and results.

7. Limitations of use.

M. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section "Quality Requirements."

N. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

O. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

P. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Q. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 1 Section "Operation and Maintenance Data."

R. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

S. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.

2. Required substrate tolerances.

3. Sequence of installation or erection.

4. Required installation tolerances.

5. Required adjustments.

6. Recommendations for cleaning and protection.

T. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.

2. Statement on condition of substrates and their acceptability for installation of product.

3. Statement that products at Project site comply with requirements.

4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.

5. Results of operational and other tests and a statement of whether observed performance complies with requirements.

6. Statement whether conditions, products, and installation will affect warranty.

7. Other required items indicated in individual Specification Sections.

U. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

V. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect, except as required in "Action Submittals" Article.

1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S/ ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. REVIEWED or REJECTED or REVISED AND RESUBMIT or FURNISH AS CORRECTED

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

SECTION 013520 - LEED REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes general requirements and procedures for compliance with certain U.S. Green Building Council's (USGBC) LEED prerequisites and credits needed for the Project to obtain LEED Certified certification.

1. Other LEED prerequisites and credits needed to obtain LEED certification are dependent on material selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests.

2. Additional LEED prerequisites and credits needed to obtain the indicated LEED certification are dependent on the Architect's design and other aspects of the Project that are not part of the Work of the Contract.

B. Related Sections include the following:

1. Divisions 1 through 16 Sections for LEED requirements specific to the Work of each of those Sections. These requirements may or may not include reference to LEED.

1.3 DEFINITIONS

A. LEED: Leadership in Energy & Environmental Design.

B. Regionally Manufactured Materials: Materials that are manufactured within a radius of 500 miles (800 km) from the Project location. Manufacturing refers to the final assembly of components into the building product that is installed at the Project site.

C. Regionally Extracted, Harvested, or Recovered Materials: Materials that are extracted, harvested, or recovered and manufactured within a radius of 500 miles (800 km) from the Project site.

D. Recycled Content: The percentage by weight of constituents that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer), or after consumer use (post-consumer).

1. Spills and scraps from the original manufacturing process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product are not recycled materials.

2. Discarded materials from one manufacturing process that are used as constituents in another manufacturing process are pre-consumer recycled materials.

1.4 SUBMITTALS

A. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

B. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

C. Project Materials Cost Data: Provide statement indicating total cost for building materials used for Project. Include statement indicating total cost of mechanical and electrical components.

D. LEED Action Plans: Provide preliminary submittals within 14 days of date established for commencement of the Work indicating how the following requirements will be met.

1. Credit MR 2.1 (and 2.2, if applicable): Waste management plan complying with Division 1 Section "Construction Waste Management."

2. Credit MR 4.1 (and 4.1 if applicable): List of proposed materials with recycled content.

a. Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.

3. Credit MR 5.1 (and 5.2 if applicable): List of proposed regionally manufactured materials and regionally extracted, harvested, or recovered materials.

a. Identify each regionally manufactured material, its source, and cost.
b. Identify each regionally extracted, harvested or recovered material, its source, and cost.

4. Credit EQ 3.1: Construction indoor air quality management plan.

E. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plans for the following:

1. Credit MR 2.1 and 2.2: Waste reduction progress reports complying with Division 1 Section "Construction Waste Management."

2. Credit MR 4.1 and 4.2: Recycled content.

3. Credit MR 5.1 and 5.2: Regionally manufactured materials and regionally extracted, harvested, or recovered materials.

F. LEED Documentation Submittals:

1. Credit WE 3.1: Product Data for plumbing fixtures indicating water consumption.

2. Prerequisite EA 3.0: Product Data for new HVAC equipment indicating absence of CFC refrigerants. Phase-out plan to replace CFC refrigerants in HVAC&R systems with CFC-free refrigerants within the Construction Period.

3. Credit EA 4.0: Product Data for new HVAC equipment indicating absence of HCFC refrigerants, and for clean-agent fire-extinguishing systems indicating absence of HCFC and Halon.

4. Credit MR 2.1 and 2.2: Comply with Division 1 Section "Construction Waste Management."

5. Credit MR 4.1 and 4.2: Product Data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.

6. Credit MR 5.1 and 5.2: Product Data indicating location of material manufacturer for regionally manufactured materials.

    a. Include statement indicating cost and distance from manufacturer to Project for each regionally manufactured material.
    b. Include statement indicating cost and distance from point of extraction, harvest, or recovery to Project for each raw material used in regionally manufactured materials.

7. Credit EQ 1.0: Product Data and Shop Drawings for carbon dioxide monitoring system.

8. Credit EQ 3.1:

    a. Construction indoor air quality management plan.
    b. Product Data for temporary filtration media.
    c. Product Data for filtration media used during occupancy.
    d. Construction Documentation: Six photographs at three different occasions during construction along with a brief description of the SMACNA approach employed, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.

9. Credit EQ 3.2:

    a. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
    b. Product Data for filtration media used during flush-out and during occupancy.
    c. Report from testing and inspecting agency indicating results of IAQ testing and documentation showing conformance with IAQ testing procedures and requirements.

10. Credit EQ 4.1: Product Data for adhesives and sealants used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

11. Credit EQ 4.2: Product Data for paints and coatings used on the interior of the building indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

12. Credit EQ 4.3: Product Data for carpet products indicating VOC content of each product used.

13. Credit EQ 4.4: Product Data for composite wood and agrifiber products indicating that products contain no urea-formaldehyde resin.

    a. Include statement indicating adhesives and binders used for each product.

14. Credit EQ 6.2: Product Data and Shop Drawings for sensors and control system used to provide individual airflow and temperature controls for minimum 50 percent of non-perimeter, regularly occupied space.

15. Credit EQ 7: Product Data and Shop Drawings for sensors and control system used to monitor and control room temperature and humidity.

PART 2 PRODUCTS

2.1 RECYCLED CONTENT OF MATERIALS

A. Credit MR 4.1: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of five percent of the cost of materials used for the Project.

B. Credits MR 4.1 and MR 4.2: Provide building materials with recycled content such that post-consumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 10 percent of the cost of materials used for the Project.

1. The cost of post-consumer recycled content of an item shall be determined by dividing the weight of post-consumer recycled content in the item by the total weight of the item and multiplying by the cost of the item.

2. The cost of post consumer recycled content plus one-half of pre-consumer recycled content of an item shall be determined by dividing the weight of post-consumer recycled content plus one-half of pre-consumer recycled content in the item by the total weight of the item and multiplying by the cost of the item.

3. Do not include mechanical and electrical components in the calculation.

4. Recycled content of materials shall be defined according to the Federal Trade Commission's "Guide for the Use of Environmental Marketing Claims," 16 CFR 260.7 (e).

2.2 REGIONAL MATERIALS

A. Credit MR 5.1: Provide 20 percent of building materials (by cost) that are regionally manufactured materials.

B. Credit MR 5.2: Of the regionally manufactured materials required by Paragraph "Credit MR 5.1" above, provide at least 50 percent (by cost) that are regionally extracted, harvested, or recovered materials.

2.3 LOW-EMITTING MATERIALS

A. Credit EQ 4.1: For interior applications use adhesives and sealants that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24):

1. Wood Glues: 30 g/L.
2. Metal to Metal Adhesives: 30 g/L.
3. Adhesives for Porous Materials (Except Wood): 50 g/L.
4. Subfloor Adhesives: 50 g/L.
5. Plastic Foam Adhesives: 50 g/L.
6. Carpet Adhesives: 50 g/L.
7. Carpet Pad Adhesives: 50 g/L.
8. VCT and Asphalt Tile Adhesives: 50 g/L.
9. Cove Base Adhesives: 50 g/L.
10. Gypsum Board and Panel Adhesives: 50 g/L.
11. Rubber Floor Adhesives: 60 g/L.
12. Ceramic Tile Adhesives: 65 g/L.
13. Multipurpose Construction Adhesives: 70 g/L.
14. Fiberglass Adhesives: 80 g/L.
15. Structural Glazing Adhesives: 100 g/L.
16. Wood Flooring Adhesive: 100 g/L.
17. Contact Adhesive: 250 g/L.
18. Plastic Cement Welding Compounds: 350 g/L.
19. ABS Welding Compounds: 400 g/L.
20. CPVC Welding Compounds: 490 g/L.
21. PVC Welding Compounds: 510 g/L.
22. Adhesive Primer for Plastic: 650 g/L.
23. Sealants: 250 g/L.

24. Sealant Primers for Nonporous Substrates: 250 g/L.

25. Sealant Primers for Porous Substrates: 775 g/L.

B. Credit EQ 4.2: For interior applications use paints and coatings that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24) and the following chemical restrictions:

1. Flat Paints and Coatings: VOC not more than 50 g/L.

2. Non-Flat Paints and Coatings: VOC not more than 150 g/L.

3. Anti-Corrosive Coatings: VOC not more than 250 g/L.

4. Varnishes and Sanding Sealers: VOC not more than 350 g/L.

5. Stains: VOC not more than 250 g/L.

6. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).

7. Restricted Components: Paints and coatings shall not contain any of the following:

a. Acrolein.
b. Acrylonitrile.
c. Antimony.
d. Benzene.
e. Butyl benzyl phthalate.
f. Cadmium.
g. Di (2-ethylhexyl) phthalate.
h. Di-n-butyl phthalate.
i. Di-n-octyl phthalate.
j. 1,2-dichlorobenzene.
k. Diethyl phthalate.
l. Dimethyl phthalate.
m. Ethylbenzene.
n. Formaldehyde.
o. Hexavalent chromium.
p. Isophorone.
q. Lead.
r. Mercury.
s. Methyl ethyl ketone.
t. Methyl isobutyl ketone.
u. Methylene chloride.
v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.
y. Vinyl chloride.

C. Credit EQ 4.4: Do not use composite wood and agrifiber products that contain urea-formaldehyde resin.

PART 3 EXECUTION

3.1 REFRIGERANT AND CLEAN-AGENT FIRE-EXTINGUISHING-AGENT REMOVAL

A. Prerequisite EA 3.0: Remove CFC-based refrigerants from existing HVAC and refrigeration equipment indicated to remain and replace with refrigerants that are not CFC based. Replace or adjust existing equipment to accommodate new refrigerant as described in Division 15 Sections.

B. Credit EA 4.0: Remove HCFC-based refrigerants from existing HVAC and refrigeration equipment indicated to remain and replace with refrigerants that are not HCFC based. Replace or adjust equipment to accommodate new refrigerant. Remove clean-agent fire-extinguishing agents that contain HCFCs or halons, and replace with agent that does not contain HCFCs or halons.

1. Refer to Division 15 for additional requirements.

3.2 CONSTRUCTION WASTE MANAGEMENT

A. Credit MR 2.1 and 2.2: Comply with Division 1 Section "Construction Waste Management."

3.3 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT

A. Credit EQ 3.1: Comply with SMACNA IAQ Guideline for Occupied Buildings under Construction.

1. If Owner authorizes the use of permanent heating, cooling, and ventilating systems during construction period as specified in Division 1 Section "Temporary Facilities and Controls," install filter media having a MERV 8 according to ASHRAE 52.2 at each return-air inlet for the air-handling system used during construction.

B. Credit EQ 3.2:

1. Conduct a two-week building air flush-out after construction ends with new air filters and 100 percent outdoor air. Replace air filters after building air flush-out. Replacement air filters shall have a MERV 13 according to ASHRAE 52.2.

END OF SECTION

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

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

1.3 RELATED SECTIONS

A. Coordination – Section 01040.

B. Testing and inspection – Section 014100.

C. Divisions 2 through 33 Sections for specific test and inspection requirements.

1.4 DEFINITIONS

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

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

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

1.5 DELEGATED DESIGN

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

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.6 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

D. 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. Ambient conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

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

1.7 QUALITY ASSURANCE

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

B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

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

D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Utah and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.

G. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.

H. Preconstruction Testing: Testing agency shall perform preconstruction testing for compliance with specified requirements for performance and test methods.

1. Contractor responsibilities include the following:

a. Provide test specimens and assemblies representative of proposed materials and construction. Provide sizes and configurations of assemblies to adequately demonstrate capability of product to comply with performance requirements.

b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Fabricate and install test assemblies using installers who will perform the same tasks for Project.
d. When testing is complete, remove assemblies; do not reuse materials on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.

2. Notify Architect seven days in advance of dates and times when mockups will be constructed.

3. Demonstrate the proposed range of aesthetic effects and workmanship.

4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

6. Demolish and remove mockups, unless otherwise directed by the Architect.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

3.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 014100 - TESTING AND INSPECTION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 WORK INCLUDED

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the testing and inspection requirements as specified herein.

1.3 RELATED SECTIONS

A. Requirements for testing and inspection shall be described in various Sections of these Specifications. Where no testing and inspection requirements are described but the Owner decides that it is required, the Owner may require additional testing and inspection to be performed at his own expense.

B. Work Not Included

1. Unless otherwise noted in this Section or other Section of work, the Owner will select a pre-qualified independent testing laboratory and inspection professional.

2. Unless otherwise noted in this Section or other Sections of work, the Owner will pay for all initial services of the testing laboratory and inspection professionals as further described in Article 2.1 of this Section of these Specifications.

1.4 QUALITY ASSURANCE

A. The testing laboratory will be qualified to the Owner's approval in accordance with ASTM E-329-95 “Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction".

B. Testing, when required, will be in accordance with all pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

1.5 PRODUCT HANDLING

A. Promptly process and distribute all required copies of test reports and related instructions to ensure all necessary retesting and/or replacement of materials with the least possible delay in progress of the work.

PART 2 PRODUCTS

2.1 PAYMENTS FOR TESTING AND INSPECTION SERVICES

A. Initial Services: The Owner will pay for all initial testing and inspection services.

B. Retesting: When initial tests and inspections indicate non-compliance with local Codes and the Contract Documents, all subsequent retesting occasioned by the non-

compliance shall be performed by the same testing laboratory and inspectors and the costs thereof will be deducted by the Owner from the Contract Sum.

2.2 CODE COMPLIANCE TESTING AND INSPECTION

A. Controlled inspections and tests required by City Codes or Ordinances, shall be paid by for by the Owner unless otherwise noted in this Section or other Sections of work. Retesting or inspection as required shall conform to the requirements of Article 2.1 B of this Section.

2.3 CONTRACTOR'S TESTING

A. Inspection or testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

B. Where operating tests are specified, the Contractor shall test his work as it progresses, on his own account, and shall make satisfactory preliminary tests in all cases before applying for official tests.

C. Tests shall be made in the manner specified, for the different branches of the work. Each test shall be made on the entire system for which such test is required, wherever practical. In case it is necessary to test portions of the work independently, the Contractor shall do so without extra compensation. The Contractor shall furnish all labor, material and apparatus, make corrections and conduct the official test. The test will be conducted in the presence of a representative of the Architect.

D. All parts of the mechanical and electrical work and associated equipment shall be tested and adjusted to work properly and be left in perfect operating condition. All defects disclosed by these tests shall be corrected to the satisfaction of the Architect and Engineer without any additional cost to the Owner. Tests shall be repeated on this repaired or replaced work if deemed necessary by the Architect. The Architect shall be notified at least forty-eight (48) hours in advance of all test, and shall be represented at tests that he deems necessary. The Contractor shall furnish all necessary instruments, other equipment, and personnel required for such tests.

E. Required certificates of inspection, testing or approval shall be secured by the Contractor and promptly delivered by him to the Architect.

F. If the Architect or Engineer is to observe the inspections, tests or approvals required by the Contract Documents, he will endeavor to do so promptly and, where practicable, at the source of supply.

PART 3 EXECUTION

3.1 COOPERATION WITH TESTING LABORATORY AND INSPECTORS

A. Representatives of the testing laboratory and inspectors shall have access to the work at all times. Provide facilities for such access in order that they may properly perform their functions.

3.2 SCHEDULES

A. Establishing Schedule

1. By advance discussions with the inspection service and testing laboratory selected by the Owner, determine the time required to perform inspections and tests and to issue each of its findings.

2. Provide all required time within the construction schedule.

B. Revising Schedule

1. When changes of construction schedule are necessary during construction, coordinate all such changes of schedule with the inspectors and testing laboratory as required.

C. Adherence to Schedule

1. When the testing laboratory is ready to test according to the determined schedule but is prevented from testing or taking specimens due to incompleteness of the work, all extra costs for testing attributable to the delay will be back-charged to the Contractor.

3.3 TAKING SPECIMENS

A. All specimens and samples for testing, unless otherwise provided in these Contract Documents, will be taken by the testing laboratory; all sampling equipment and personnel will be provided by the testing laboratory; and all deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory.

END OF SECTION

SECTION 014200 - REFERENCES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 DEFINITIONS

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

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

C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by Architect, requested by Architect, and similar phrases.

D. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on Drawings; or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference.

E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": The term "furnish" means to supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": The term "install" describes operations at Project site including unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.

I. "Installer": An installer is Contractor or another entity engaged by Contractor, as an employee, subcontractor, or contractor of lower tier, to perform a particular construction operation, including installation, erection, application, and similar operations.

J. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. "Project site" is the space available for performing construction activities, either exclusively or in conjunction with others performing other work as part of Project. The extent of Project site is shown on the Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

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

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

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

D. Abbreviations and Names: Abbreviations and acronyms are frequently used in the Specifications and other Contract Documents to represent the name of a trade association, standards-developing organization, authorities having jurisdiction, or other entity in the context of referencing a standard or publication. The following abbreviations and acronyms, as referenced in the Contract Documents, mean the associated names. Names and addresses are subject to change and are believed, but are not assured, to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association 900 19th St., NW, Suite 300 Washington, DC 20006 www.aluminum.org	(202) 862-5100
AABC	Associated Air Balance Council 1518 K St., NW, Suite 503 Washington, DC 20005 www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association 1827 Walden Office Sq., Suite 104 Schaumburg, IL 60173-4268 www.aamanet.org	(847) 303-5664

AAN	American Association of Nurserymen (See ANLA)	
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol St., NW, Suite 249 Washington, DC 20001 www.aashto.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists P.O. Box 12215 One Davis Dr. Research Triangle Park, NC 27709-2215 www.aatcc.org	(919) 549-8141
ABMA	American Bearing Manufacturers Association (Formerly: Anti-Friction Bearing Manufacturers Association) 1200 19th St., NW, Suite 300 Washington, DC 20036-2401 www.abma-dc.org	(202) 429-5155
ABMA	American Boiler Manufacturers Association 950 North Glebe Rd., Suite 160 Arlington, VA 22203-1824 www.abma.com	(703) 522-7350
ACI	American Concrete Institute P.O. Box 9094 Farmington Hills, MI 48333-9094 www.aci-int.org	(248) 848-3700
ACIL	ACIL: The Association of Independent Scientific, Engineering, and Testing Firms 1629 K St., NW, Suite 400 Washington, DC 20006 www.acil.org	(202) 887-5872
ACPA	American Concrete Pipe Association 222 West Las Colinas Blvd., Suite 641 Irving, TX 75039-5423 www.concrete-pipe.org	(972) 506-7216
ADC	Air Diffusion Council 104 South Michigan Ave., Suite 1500 Chicago, IL 60603	(312) 201-0101
AEIC	Association of Edison Illuminating Companies 600 N. 18th St. P.O. Box 2641 Birmingham, AL 35291-0992 www.aeic.org	(205) 250-2530

AFBMA	Anti-Friction Bearing Manufacturers Association (See ABMA)	
AFPA	American Forest and Paper Association (Formerly: National Forest Products Association) 1111 19th St., NW, Suite 800 Washington, DC 20036 www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association 1515 Wilson Blvd. Arlington, VA 22209 www.aga.com	(703) 841-8400
AHA	American Hardboard Association 1210 W. Northwest Hwy Palatine, IL 60067-1897	(847) 934-8800
AHAM	Association of Home Appliance Manufacturers 20 N. Wacker Dr., Suite 1231 Chicago, IL 60606 www.aham.org	(312) 984-5800
AI	Asphalt Institute P.O. Box 14052 Lexington, KY 40512-4052 www.asphaltinstitute.org	(606) 288-4960
AIA	The American Institute of Architects 1735 New York Ave., NW Washington, DC 20006-5292 www.aia.org	(202) 626-7300
AIA	American Insurance Association 1130 Connecticut Ave., NW, Suite 1000 Washington, DC 20036	(202) 828-7100
AIHA	American Industrial Hygiene Association 2700 Prosperity Ave., Suite 250 Fairfax, VA 22031 www.aiha.org	(703) 849-8888
AISC	American Institute of Steel Construction One East Wacker Dr., Suite 3100 Chicago, IL 60601-2001 www.aisc.web.com	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute 1101 17th St., NW, Suite 1300 Washington, DC 20036-4700 www.steel.org	(202) 452-7100

AITC	American Institute of Timber Construction 7012 S. Revere Pkwy, Suite 140 Englewood, CO 80112 www.aitc-glulam.org	(303) 792-9559
ALA	American Laminators Association (See LMA)	
ALCA	Associated Landscape Contractors of America 150 Elden St., Suite 270 Herndon, VA 20170-4831 www.alca.org	(800) 395-2522 (703) 736-9666
ALI	Associated Laboratories, Inc. P.O. Box 152837 Dallas, TX 75315 www.assoc-labs.com	(214) 565-0593
ALSC	American Lumber Standards Committee P.O. Box 210 Germantown, MD 20875	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. 30 W. University Dr. Arlington Heights, IL 60004-1893 www.amca.org	(847) 394-0150
ANLA	American Nursery and Landscape Association (Formerly: American Association of Nurserymen) 1250 Eye St., NW, Suite 500 Washington, DC 20005 www.anla.org	(202) 789-2900
ANSI	American National Standards Institute 11 West 42nd St., 13th Floor New York, NY 10036-8002 www.ansi.org	(888) 267-4783 (212) 642-4900
AOAC	AOAC International 481 N. Frederick Ave., Suite 500 Gaithersburg, MD 20877 www.aoac.org	(301) 924-7077

AOSA	Association of Official Seed Analysts P.O. Box 81152 Lincoln, NE 68501-1152 www.zianet.com/AOSA	(402) 476-3852
APA	APA-The Engineered Wood Association (Formerly: American Plywood Association) P.O. Box 11700 Tacoma, WA 98411-0700 www.apawood.org	(253) 565-6600
APA	Architectural Precast Association P.O. Box 08669 Fort Myers, FL 33908-0669 www.archprecast.org	(941) 454-6989
API	American Petroleum Institute 1220 L St., NW, Suite 900 Washington, DC 20005-8029 www.api.org	(202) 682-8000
ARI	Air-Conditioning and Refrigeration Institute 4301 Fairfax Dr., Suite 425 Arlington, VA 22203 www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association Center Park 4041 Powder Mill Rd., Suite 404 Calverton, MD 20705 www.asphaltroofing.org	(301) 348-2002
ASA	Acoustical Society of America 500 Sunnyside Blvd. Woodbury, NY 11797 //asa.aip.org	(516) 576-2360
ASC	Adhesive and Sealant Council 1627 K St., NW, Suite 1000 Washington, DC 20006-1707 www.ascouncil.org	(202) 452-1500
ASCA	Architectural Spray Coaters Association 895 Doncaster Dr. West Deptford, NJ 08066	(609) 848-6120
ASCE	American Society of Civil Engineers World Headquarters 1801 Alexander Graham Bell Dr. Reston, VA 20191-4400 www.asce.org	(800) 548-2723 (703) 295-6000

ASHES	American Society for Healthcare Environmental Services Division of the American Hospital Association One North Franklin, Suite 2700 Chicago, IL 60606	(312) 422-3860
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers 1791 Tullie Circle, NE Atlanta, GA 30329-2305 www.ashrae.org	(800) 527-4723 (404) 636-8400
ASLA	American Society of Landscape Architects 636 Eye St., NW Washington, DC 20001-3736 www.asla.org	(202) 898-2444
ASME	American Society of Mechanical Engineers 345 East 47th St. New York, NY 10017-2392 www.asme.org	(800) 843-2763 (212) 705-7722
ASPA	American Sod Producers Association (See TPI)	
ASPE	American Society of Plumbing Engineers 3617 Thousand Oaks Blvd., Suite 210 Westlake Village, CA 91362-3649	(805) 495-7120
ASQ	American Society for Quality 611 East Wisconsin Ave. Milwaukee, WI 53201-3005 www.asq.org	(800) 248-1946 (414) 272-8575
ASSE	American Society of Sanitary Engineering 28901 Clemens Rd. Westlake, OH 44145 www.asse-plumbing.org	(440) 835-3040
ASTM	American Society for Testing and Materials 100 Barr Harbor Dr. West Conshohocken, PA 19428-2959 www.astm.org	(610) 832-9500
ATIS	Alliance for Telecommunications Industry Solutions (Formerly: Exchange Carriers Standards Association) 1200 G St., NW, Suite 500 Washington, DC 20005 www.atis.org	(202) 628-6380

AWCI	Association of the Wall and Ceiling Industries--International 803 West Broad St., Suite 600 Falls Church, VA 22046 www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (See WCMA)	
AWI	Architectural Woodwork Institute 1952 Isaac Newton Sq. West Reston, VA 20190 www.awinet.org	(800) 449-8811 (703) 733-0600
AWPA	American Wood-Preservers' Association P.O. Box 5690 Granbury, TX 76049 www.awpa.com	(817) 326-6300
AWPB	American Wood Preservers' Bureau (This organization is now defunct.)	
AWS	American Welding Society 550 NW LeJeune Rd. Miami, FL 33126 www.amweld.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association 6666 W. Quincy Ave. Denver, CO 80235 www.awwa.org	(800) 926-7337 (303) 794-7711
BAC	Brick Association of the Carolinas (Formerly: Brick Association of North Carolina) P.O. Box 13290 Greensboro, NC 27415-3290 www.gobrick.com	(800) 622-7425 (336) 273-5566
BHMA	Builders Hardware Manufacturers Association 355 Lexington Ave., 17th Floor New York, NY 10017-6603	(212) 661-4261
BIA	Brick Industry Association 11490 Commerce Park Dr. Reston, VA 22091-1525 www.bia.org	(703) 620-0010

BIFMA	The Business and Institutional Furniture Manufacturer's Association International 2680 Horizon Dr., SE, Suite A1 Grand Rapids, MI 49546-7500 www.bifma.com	(616) 285-3963
CAGI	Compressed Air and Gas Institute c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851 www.taol.com/cagi	(216) 241-7333
CAUS	Color Association of the United States 409 W. 44th St. New York, NY 10036-4402	(212) 582-6884
CBMA	Certified Ballast Manufacturers Association 355 Lexington Ave., 17th Floor New York, NY 10017 www.certbal.org	(212) 661-4261
CCC	Carpet Cushion Council P.O. Box 546 Riverside, CT 06878-0546	(203) 637-1312
CDA	Copper Development Association Inc. 260 Madison Ave., 16th Floor New York, NY 10016-2401 www.copper.org	(800) 232-3282 (212) 251-7200
CFFA	Chemical Fabrics & Film Association, Inc. c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851 www.taol.com/cffa	(216) 241-7333
CGA	Compressed Gas Association 1725 Jefferson Davis Hwy, Suite 1004 Arlington, VA 22202-4102 www.cganet.com	(703) 412-0900

CGSB	Canadian General Standards Board Place du Portage Phase III, 6B1 11 Laurier St. Hull, Quebec K1A 0S5 CANADA www.pwgsc.gc.ca/cgsb Mailing Address: Canadian General Standards Board Sales Centre Ottawa K1A 1G6 CANADA	(819) 956-3500 (819) 956-0425
CISCA	Ceilings and Interior Systems Construction Association 1500 Lincoln Hwy, Suite 202 St. Charles, IL 60174 www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute 5959 Shallowford Rd., Suite 419 Chattanooga, TN 37421 www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute 9891 Broken Land Pkwy, Suite 300 Columbia, MD 21046 www.baileadership.com	(301) 596-2584
CPA	Composite Panel Association (Formerly: National Particleboard Association) 18928 Premiere Ct. Gaithersburg, MD 20879-1569 www.pbmdf.com	(301) 670-0604
CPPA	Corrugated Polyethylene Pipe Association 3621 Secor Rd., Suite 320 Toledo, OH 436046 www.cppa-info.org	(800) 510-2772 (419) 241-2221
CRI	Carpet and Rug Institute 310 S. Holiday Ave. Dalton, GA 30722-2048 www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Rd. Schaumburg, IL 60173-4758 www.crsi.org	(847) 517-1200

CSSB	Cedar Shake and Shingle Bureau 515 116th Ave., NE, Suite 275 Bellevue, WA 98004-5294 www.cedarbureau.org	(206) 453-1323
CTI	Ceramic Tile Institute of America 12061 West Jefferson Blvd. Culver City, CA 90230-6219	(310) 574-7800
CTI	Cooling Tower Institute P.O. Box 73383 Houston, TX 77273 www.cti.org	(281) 583-4087
DASMA	Door and Access Systems Manufacturers Association, International (Formerly: National Association of Garage Door Manufacturers) c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851 www.taol.com/dasma	(216) 241-7333
DHI	Door and Hardware Institute (Formerly: National Builders Hardware Association) 14170 Newbrook Dr. Chantilly, VA 20151-2223 www.dhi.org	(703) 222-2010
DIPRA	Ductile Iron Pipe Research Association 245 Riverchase Pkwy East, Suite O Birmingham, AL 35244 www.dipra.org	(205) 402-8702
DLPA	Decorative Laminate Products Association (Dissolved in 1995 - Now part of KCMA.)	
ECSA	Exchange Carriers Standards Association (See ATIS)	
EIA	Electronic Industries Association 2500 Wilson Blvd. Arlington, VA 22201 www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association 3000 Corporate Center Dr., Suite 270 Morrow, GA 30260-4116 www.eifsfacts.com	(800) 294-3462 (770) 968-7945

EJMA	Expansion Joint Manufacturers Association 25 N. Broadway Tarrytown, NY 10591-3201 www.ejma.org	(914) 332-0040
ETL	ETL Testing Laboratories, Inc. (Now part of ITS)	
FCI	Fluid Controls Institute c/o Thomas Associates, Inc 1300 Sumner Ave. Cleveland, OH 44115-2851 www.taol.com/fci	(216) 241-7333
FCICA	Floor Covering Installation Contractors Association P.O. Box 948 Dalton, GA 30722-0948	(706) 226-5488
FGMA	Flat Glass Marketing Association (See GANA)	
FM	Factory Mutual System 1151 Boston-Providence Tnpk. P.O. Box 9102 Norwood, MA 02062-9102 www.factorymutual.com	(781) 762-4300
GA	Gypsum Association 810 First St., NE, Suite 510 Washington, DC 20002 www.usg.com	(202) 289-5440
GANA	Glass Association of North America (Formerly: Flat Glass Marketing Association) 2945 Southwest Wanamaker Dr., Suite A Topeka, KS 66614 www.glasswebsite.com/gana	(913) 266-7013
GRI	Geosynthetic Research Institute 475 Kedron Ave. Folsom, PA 19033 www.drexel.edu/gri	(610) 522-8440
HEI	Heat Exchange Institute c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851 www.taol.com/hei	(216) 241-7333

HI	Hydraulic Institute 9 Sylvan Way Parsippany, NJ 07054-3802	(888) 786-7744 (973) 267-9700
HI	Hydronics Institute Division of Gas Appliance Manufacturers Association P.O. Box 218 35 Russo Pl. Berkeley Heights, NJ 07922 www.gamanet.org	(908) 464-8200
HMA	Hardwood Manufacturers Association (Formerly: Southern Hardwood Lumber Manufacturers Association) 400 Penn Center Blvd., Suite 530 Pittsburgh, PA 15235-5605 www.hardwood.org	(412) 829-0770
HPVA	Hardwood Plywood and Veneer Association 1825 Michael Farraday Dr. P.O. Box 2789 Reston, VA 22195-0789 www.hpva.org	(703) 435-2900
IAS	International Approval Services Division of Canadian Standards Association 8501 East Pleasant Valley Rd. Cleveland, OH 44131 www.iasapprovals.org	(216) 524-4990
IBD	Institute of Business Designers (Now part of IIDA)	
ICC	International Code Council 5203 Leesburg Pike #708 Falls Church, VA 22041 www.intlcode.org	(703) 931-4533
ICEA	Insulated Cable Engineers Association P.O. Box 440 South Yarmouth, MA 02664 www.icea.net	(508) 394-4424
IEC	International Electrotechnical Commission (Available from ANSI) 11 West 42nd St., 13th Floor New York, NY 10036-8002 www.ansi.org	(888) 267-4783 (212) 642-4900

IEEE	Institute of Electrical and Electronics Engineers 345 E. 47th St. New York, NY 10017-2394 www.ieee.org	(800) 678-4333 (212) 705-7900
IESNA	Illuminating Engineering Society of North America 120 Wall St., 17th Floor New York, NY 10005-4001 www.iesna.org	(212) 248-5000
IGCC	Insulating Glass Certification Council P.O. Box 9 Henderson Harbor, NY 13651	(315) 938-7444
IIDA	International Interior Design Association 341 Merchandise Mart Chicago, IL 60654-1104 www.iida.com	(800) 888-4432 (312) 467-1950
ILI	Indiana Limestone Institute of America Stone City Bank Building, Suite 400 Bedford, IN 47421 www.iliai.com	(812) 275-4426
IMSA	International Municipal Signal Association P.O. Box 539 165 E. Union St. Newark, NY 14513 www.imsasafety.org	(800) 723-4672 (315) 331-2182
INCE	Institute of Noise Control Engineering P.O. Box 3206, Arlington Branch Poughkeepsie, NY 12603 www.ince.org	(914) 462-4006
IRI	HSB Industrial Risk Insurers P.O. Box 5010 85 Woodland St. Hartford, CT 06102-5010 www.industrialrisk.com	(800) 520-7300 (860) 520-7300
ISA	ISA - International Society for Measurement and Control P.O. Box 12277 67 Alexander Dr. Research Triangle Park, NC 27709 www.isa.org	(919) 549-8411
ISEA	Industrial Safety Equipment Association 1901 N. Moore St., Suite 808 Arlington, VA 22209 www.safetycentral.org/isea	(703) 525-1695

ISS	Iron and Steel Society 410 Commonwealth Dr. Warrendale, PA 15086-7512 www.issource.org	(412) 776-1535
ITS	Intertek Testing Services (Formerly: Inchcape Testing Services) P.O. Box 2040 3933 US Route 11 Cortland, NY 13045-7902 www.itsglobal.com	(800) 345-3851 (607) 753-6711
KCMA	Kitchen Cabinet Manufacturers Association (Formerly: National Kitchen Cabinet Association) 1899 Preston White Dr. Reston, VA 22191 www.kema.org	(703) 264-1690
LGSI	Light Gage Structural Institute P.O. Box 560746 The Colony, TX 75056	(972) 625-4560
LIA	Lead Industries Association, Inc. 295 Madison Ave., Suite 808 New York, NY 10017 www.leadinfo.com	(800) 422-5323 (212) 578-4750
LMA	Laminating Materials Association (Formerly: American Laminators Association) 116 Lawrence St. Hillsdale, NJ 07642-2730 www.lma.org	(201) 664-2700
LPI	Lightning Protection Institute 3335 N. Arlington Heights Rd., Suite E Arlington Heights, IL 60004-7700 www.lightning.org	(800) 488-6864 (847) 577-7200
MBMA	Metal Building Manufacturers Association c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851 www.taol.com/mbma	(216) 241-7333
MCAA	Mechanical Contractors Association of America 1385 Piccard Dr. Rockville, MD 20850-4329 www.mcaa.org	(301) 869-5800

MFMA	Maple Flooring Manufacturers Association (Formerly: Wood and Synthetic Flooring Institute) 60 Revere Dr., Suite 500 Northbrook, IL 60062 www.maplefloor.com	(847) 480-9138
MFMA	Metal Framing Manufacturers Association 401 N. Michigan Ave. Chicago, IL 60611	(312) 644-6610
MHIA	Material Handling Industry Association 8720 Red Oak Blvd., Suite 201 Charlotte, NC 28217-3957 www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America 30 Eden Alley, Suite 301 Columbus, OH 43215 www.marble-institute.com	(614) 228-6194
MIA	Masonry Institute of America 2550 Beverly Blvd. Los Angeles, CA 90057 www.masonryinstitute.org	(213) 388-0472
ML/SFA	Metal Lath/Steel Framing Association 8 South Michigan Ave., Suite 1000 Chicago, IL 60603	(312) 456-5590
MRCA	Midwest Roofing Contractors Association 4840 W. 15th St., Suite 1000 Lawrence, KS 66049 www.mrca.org	(913) 843-4888
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry 127 Park St., NE Vienna, VA 22180-4602 www.mss-hq.com	(703) 281-6613
NAA	National Arborist Association P.O. Box 1094 Amherst, NH 03031-1094 www.natlarb.com	(800) 733-2622 (603) 673-3311
NAAMM	National Association of Architectural Metal Manufacturers 8 South Michigan Ave., Suite 1000 Chicago, IL 60603 www.gss.net/naamm	(312) 322-0405

NAAMM	North American Association of Mirror Manufacturers (See GANA) 2945 Southwest Wanamaker Dr., Suite A Topeka, KS 66614 www.glasswebsite.com/naamm	(913) 266-7013
NACE	NACE International (Formerly: National Association of Corrosion Engineers) P.O. Box 218340 Houston, TX 77218-8340	(281) 492-0535 (281) 492-8254
NAGDM	National Association of Garage Door Manufacturers (See DASMA)	
NAIMA	North American Insulation Manufacturers Association (Formerly: Thermal Insulation Manufacturers Association) 44 Canal Center Plaza, Suite 310 Alexandria, VA 22314 www.naima.org	(703) 684-0084
NAMI	National Accreditation & Management Institute, Inc. P.O. Box 366 207 S. Washington St. Berkeley Springs, WV 25411	(304) 258-5100
NAPA	National Asphalt Pavement Association NAPA Building 5100 Forbes Blvd. Lanham, MD 20706-4413 www.hotmix.org	(888) 468-6499 (301) 731-4748
NBHA	National Builders Hardware Association (See DHI)	
NBGQA	National Building Granite Quarries Association, Inc. 1220 L. St., NW, Suite 100-167 Washington, DC 20005	(800) 557-2848
NCAC	National Council of Acoustical Consultants 66 Morris Ave., Suite 1A Springfield, NJ 07081 www.ncac.com	(973) 564-5859
NCCA	National Coil Coaters Association 401 N. Michigan Ave. Chicago, IL 60611 www.coilcoaters.org	(312) 321-6894

NCMA	National Concrete Masonry Association 2302 Horse Pen Rd. Herndon, VA 20171-3499 www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute P.O. Box 759 253-80 Center St. Lake Geneva, WI 53147 www.ncpi.org	(414) 248-9094
NCRPM	National Council on Radiation Protection and Measurements 7910 Woodmont Ave., Suite 800 Bethesda, MD 20814-3095 www.ncrp.com	(800) 229-2652 (301) 657-2652
NCSPA	National Corrugated Steel Pipe Association 1255 23rd St., NW, Suite 850 Washington, DC 20037 www.ncspa.org	(202) 452-1700
NEBB	Natural Environmental Balancing Bureau 8575 Grovemont Circle Gaithersburg, MD 20877-4121 www.mcaa.org/nebb.htm www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association 3 Bethesda Metro Center, Suite 1100 Bethesda, MD 20814-3299 www.necanet.org	(301) 657-3110
NEI	National Elevator Industry 185 Bridge Plaza North, Suite 310 Fort Lee, NJ 07024	(201) 944-3211
NELMA	Northeastern Lumber Manufacturers Association 272 Tuttle Rd. P.O. Box 87A Cumberland Center, ME 04021 www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association 1300 N 17th St., Suite 1847 Rosslyn, VA 22209 www.nema.org	(703) 841-3200

NETA	InterNational Electrical Testing Association P.O. Box 687 106 Stone St. Morrison, CO 80465-1526 www.electricnet.com/neta	(303) 697-8441
NFPA	National Fire Protection Association One Batterymarch Park P.O. Box 9101 Quincy, MA 02269-9101 www.nfpa.org	(800) 344-3555 (617) 770-3000
NFPA	National Forest Products Association (See AFPA)	
NFRC	National Fenestration Rating Council Incorporated 1300 Spring St., Suite 500 Silver Spring, MD 20910 www.nfrc.org	(301) 589-6372
NGA	National Glass Association 8200 Greensboro Drive, 3rd Floor McLean, VA 22102-3881	(703) 442-4890
NHLA	National Hardwood Lumber Association P.O. Box 34518 Memphis, TN 38184-0518 www.natlhardwood.org	(901) 377-1818
NIA	National Insulation Association (Formerly: National Insulation and Abatement Contractors Association) 99 Canal Center Plaza, Suite 222 Alexandria, VA 22314 www.insulation.org	(703) 683-6422
NIAC	National Insulation and Abatement Contractors Association (See NIA)	
NKCA	National Kitchen Cabinet Association (See KCMA)	
NLGA	National Lumber Grades Authority #406-First Capital Pl. 960 Quayside Dr. New Westminster, BC V3M 6G2 CANADA	(604) 524-2393

NOFMA	National Oak Flooring Manufacturers Association P.O. Box 3009 Memphis, TN 38173-0009 www.nofma.org	(901) 526-5016
NPA	National Parking Association 1112 16th Street, NW, Suite 300 Washington, DC 20036	(202) 296-4336 (800) 647-7275
NPCA	National Paint and Coatings Association 1500 Rhode Island Ave., NW Washington, DC 20005-5597 www.paint.org	(202) 462-6272
NRCA	National Roofing Contractors Association O'Hare International Center 10255 W. Higgins Rd., Suite 600 Rosemont, IL 60018-5607 www.roofonline.org	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association 900 Spring St. Silver Spring, MD 20910 www.nrmca.org	(301) 587-1400
NSA	National Stone Association 1415 Elliot Pl., NW Washington, DC 20007 www.aggregates.org	(800) 342-1415 (202) 342-1100
NSF	NSF International (Formerly: National Sanitation Foundation) 3475 Plymouth Rd. Ann Arbor, MI 48105 www.nsf.org	(734) 769-8010
NSSEA	National School Supply and Equipment Association 8300 Colesville Rd., Suite 250 Silver Spring, MD 20910 www.nssea.org	(800) 395-5550 (301) 495-0240
NTMA	National Terrazzo and Mosaic Association 110 E. Market St., Suite 200-A Leesburg, VA 20176-3122 www.ntma.com	(800) 323-9736 (703) 779-1022
NUSIG	National Uniform Seismic Installation Guidelines P.O. Box 0933 Alamo, CA 94507	(925) 555-6331

NWMA	National Woodwork Manufacturers Association (See NWWDA)	
NWWDA	National Wood Window and Door Association (Formerly: National Woodwork Manufacturers Association) 1400 E. Touhy Ave. Des Plaines, IL 60018 www.nwwda.org	(800) 223-2301 (847) 299-5200
PATMI	Powder Actuated Tool Manufacturers' Institute 1603 Boonslick Rd. St. Charles, MO 63301-2244	(314) 947-6610
PCA	Portland Cement Association 5420 Old Orchard Rd. Skokie, IL 60077-1083 www.portcement.org	(847) 966-6200
PCI	Precast/Prestressed Concrete Institute 175 W. Jackson Blvd. Chicago, IL 60604 www.pci.org	(312) 786-0300
PDCA	Painting and Decorating Contractors of America 3913 Old Lee Hwy, Suite 33-B Fairfax, VA 22030 www.pdca.com	(800) 332-7322 (703) 359-0826
PDI	Plumbing and Drainage Institute 45 Bristol Dr., Suite 101 South Easton, MA 02375 //pdi-online.org	(800) 589-8956 (508) 230-3516
PEI	Porcelain Enamel Institute 4004 Hillsboro Pike, Suite 224-B Nashville, TN 37215 www.porcelainenamel.com	(615) 385-5357
PGI	PVC Geomembrane Institute/Technology Program University of Illinois-Urbana Champaign 205 N. Mathews Ave. 2215 Newmark Civil Engineering Lab Urbana, IL 61801 //pgi-tp.ce.vivc.edu	(217) 333-3929
PIMA	Photographic and Imaging Manufacturers Association 550 Mamaroneck Ave., Suite 307 Harrison, NY 10528 www.pima.net	(914) 698-7603
PPFA	Plastic Pipe and Fittings Association	(888) 314-6774

	800 Roosevelt Rd., Building C, Suite 20 Glen Ellyn, IL 60137-5833	(630) 858-6540
PPI	Plastics Pipe Institute (The Society of the Plastics Industry, Inc.) 1801 K St., NW, Suite 600K Washington, DC 20006 www.plasticpipe.org	(202) 974-5306
RCMA	Roof Coatings Manufacturers Association Center Park 4041 Powder Mill Rd., Suite 404 Calverton, MD 20705 www.roofcoatings.org	(301) 348-2003
RCSC	Research Council on Structural Connections Sargent & Lundy 55 E. Monroe St. Chicago, IL 60603	(312) 269-2424
RFCI	Resilient Floor Covering Institute 966 Hungerford Dr., Suite 12-B Rockville, MD 20850-1714	(301) 340-8580
RMA	Rubber Manufacturers Association 1400 K St., NW, Suite 900 Washington, DC 20005 www.rma.org	(800) 220-7620 (202) 682-4800
SAE	SAE International 400 Commonwealth Dr. Warrendale, PA 15096-0001 For publications: Call (724) 776-4970 www.sae.org	(724) 776-4841
SDI	Steel Deck Institute P.O. Box 25 Fox River Grove, IL 60021 www.sdi.org	(847) 462-1930
SDI	Steel Door Institute 30200 Detroit Rd. Cleveland, OH 44145-1967 www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association 7 Wildbird Lane Hilton Head Island, SC 29926 www.sefalabfurn.com	(843) 689-6878

SEGD	Society for Environmental Graphic Design 401 F St., NW, Suite 333 Washington, DC 20001-2728	(202) 638-5555
SGCC	Safety Glazing Certification Council P.O. Box 9 Henderson Harbor, NY 13651	(315) 938-7444
SHLMA	Southern Hardwood Lumber Manufacturers Association (See HMA)	
SIGMA	Sealed Insulating Glass Manufacturers Association 401 N. Michigan Ave. Chicago, IL 60611-4267 www.sigmaonline.org/sigma	(312) 644-6610 x3279
SJI	Steel Joist Institute 3127 10th Ave., North Ext. Myrtle Beach, SC 29577-6760	(803) 626-1995
SMA	Screen Manufacturers Association 2850 S. Ocean Blvd., Suite 114 Palm Beach, FL 33480-5535	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association 4201 Lafayette Center Dr. P.O. Box 221230 Chantilly, VA 20151-1209 www.smacna.org	(703) 803-2980
SPI	The Society of the Plastics Industry, Inc. Spray Polyurethane Division 1801 K St., NW, Suite 600K Washington, DC 20006 www.socplas.org	(800) 951-2001 (202) 974-5200
SPIB	Southern Pine Inspection Bureau 4709 Scenic Hwy Pensacola, FL 32504-9094 www.spib.org	(850) 434-2611
SPRI	SPRI (Formerly: Single Ply Roofing Institute) 200 Reservoir St., Suite 309A Needham, MA 02494-3034 www.spri.org	(781) 444-0242

SSINA	Specialty Steel Industry of North America c/o Collier, Shannon Rill & Scott 3050 K St., NW, Suite 400 Washington, DC 20007 www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings 40 24th St., 6th Floor Pittsburgh, PA 15222-4656 www.sspc.org	(800) 837-8303 (412) 281-2331
SSPMA	Sump and Sewage Pump Manufacturers Association P.O. Box 647 Northbrook, IL 60065-0647	(847) 559-9233
STI	Steel Tank Institute 570 Oakwood Rd. Lake Zurich, IL 60047-1559 www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute c/o Thomas Associates, Inc. 1300 Sumner Ave. Cleveland, OH 44115-2851 www.taol.com/swi	(216) 241-7333
SWPA	Submersible Wastewater Pump Association 1806 Johns Dr. Glenview, IL 60025-1657	(847) 729-7972
SWRI	Sealant, Waterproofing and Restoration Institute 2841 Main St. Kansas City, MO 64108 www.swrionline.org	(816) 472-7974
TCA	Tile Council of America P.O. Box 1787 Clemson, SC 29633 www.tileusa.com	(864) 646-8453
TIMA	Thermal Insulation Manufacturers Association (See NAIMA)	
TPI	Truss Plate Institute 583 D'Onofrio Dr., Suite 200 Madison, WI 53719	(608) 833-5900

TPI	Turfgrass Producers International (Formerly: American Sod Producers Association) 1855-A Hicks Rd. Rolling Meadows, IL 60008 www.turfgrassod.org	(800) 405-8873 (847) 705-9898
UFAC	Upholstered Furniture Action Council P.O. Box 2436 High Point, NC 27261	(910) 885-6085
UL	Underwriters Laboratories Inc. 333 Pfingsten Rd. Northbrook, IL 60062 www.ul.com	(800) 704-4050 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association 2655 Villa Creek Dr., Suite 155 Dallas, TX 75234 members.aol.com/unibell	(972) 243-3902
USITT	USITT: The American Association of Design and Production Professionals in the Performing Arts 6443 Ridings Rd. Syracuse, NY 13206-1111 www.culturenet.ca/usitt	(800) 938-7488 (315) 463-6463
USP	U.S. Pharmacopeia (Formerly: U.S. Pharmacopoeial Convention) 12601 Twinbrook Pkwy Rockville, MD 20852-1790 www.usp.org	(800) 227-8772 (301) 881-0666
WA	Wallcoverings Association 401 N. Michigan Ave. Chicago, IL 60611-4267	(312) 644-6610
WASTEC	Waste Equipment Technology Association 4301 Connecticut Ave. NW, Suite 300 Washington, DC 20008	(202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau P.O. Box 23145 Portland, OR 97281-3145	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association (Formerly: American Window Covering Manufacturers Association) 355 Lexington Ave., 17th Floor New York, NY 10017-6603	(212) 661-4261

WEF	Water Environment Federation (Formerly: Water Pollution Control Federation) 601 Wythe St. Alexandria, VA 22314-1994 www.wef.org	(800) 666-0206 (703) 684-2400
WIC	Woodwork Institute of California P.O. Box 980247 West Sacramento, CA 95798-0247 www.wicnet.org	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association 507 First St. Woodland, CA 95695 www.wmmpa.com	(800) 550-7889 (530) 661-9591
WPCF	Water Pollution Control Federation (See WEF)	
WRI	Wire Reinforcement Institute 301 E. Sandusky St. Findlay, OH 45840 www.bright.net/~rreiter	(419) 425-9473
WSC	Water Systems Council Building C, Suite 20 800 Roosevelt Rd. Glen Ellyn, IL 60137	(630) 545-1762
WSFI	Wood and Synthetic Flooring Institute (See MFMA)	
WWPA	Western Wood Products Association Yeon Building 522 SW 5th Ave. Portland, OR 97204-2122 www.wwpa.org	(503) 224-3930

E. Federal Government Agencies: Names and titles of Federal Government standards- or specification-developing agencies are often abbreviated. The following abbreviations and acronyms referenced in the Contract Documents indicate names of standards- or specification-developing agencies of the Federal Government. Names and addresses are subject to change and are believed, but are not assured, to be accurate and up-to-date as of the date of the Contract Documents.

CE	Corps of Engineers (U.S. Department of the Army) 20 Massachusetts Ave., NW Washington, DC 20314 www.usace.army.mil CRD standards are available from: U.S. Army Corps of Engineers Waterways Experiment Station Technical Report Distribution Section Services Branch, TIC 3909 Halls Ferry Rd. Vicksburg, MS 39180-6199	(202) 761-0660 (601) 634-2696
CFR	Code of Federal Regulations (Available from the Government Printing Office) Washington, DC 20401 (Material is usually published first in the "Federal Register.") www.access.gpo.gov	(202) 512-1800
CPSC	Consumer Product Safety Commission East West Towers 4330 East-West Hwy Bethesda, MD 20814 www.cpcs.gov	(800) 638-2772 (301) 504-0990
CS	Commercial Standard (U.S. Department of Commerce) Government Printing Office Washington, DC 20402 For commercial standards, contact: Ms. Brenda Umberger CS & PS Specialist c/o NIST Gaithersburg, MD 20899 www.nist.gov	(202) 512-1800 (301) 975-4036
DOC	Department of Commerce 14th St. and Constitution Ave., NW Washington, DC 20230 www.doc.gov	(202) 482-2000
DOT	Department of Transportation 400 Seventh St., SW Washington, DC 20590 www.dot.gov	(202) 366-4000
EPA	Environmental Protection Agency 401 M St., SW Washington, DC 20460 www.epa.gov	(202) 260-2090

FAA	Federal Aviation Administration (U.S. Department of Transportation) 800 Independence Ave., SW Washington, DC 20591 www.faa.gov	(202) 366-4000
FCC	Federal Communications Commission 1919 M St., NW Washington, DC 20554 www.fcc.gov	(202) 418-0126
FDA	Food and Drug Administration 5600 Fishers Lane Rockville, MD 20857 www.fda.gov	(301) 443-1544
FHA	Federal Housing Administration (U.S. Department of Housing and Urban Development) 451 Seventh St., SW Washington, DC 20410 www.hud.gov	(202) 401-0388
FS	Federal Specification Unit (Available from GSA) 470 East L'Enfant Plaza, SW, Suite 8100 Washington, DC 20407 www.gsa.gov	(202) 619-8925
GSA	General Services Administration F St. and 18th St., NW Washington, DC 20405 www.gsa.gov	(202) 708-5082
MIL	Military Standardization Documents (U.S. Department of Defense) Defense Automated Printing Service 700 Robbins Ave., Building 4D Philadelphia, PA 19111 www.dodssp.daps.mil	(215) 697-2179
NIST	National Institute of Standards and Technology (U.S. Department of Commerce) Building 101, #A1134, Rte. I-270 and Quince Orchard Rd. Gaithersburg, MD 20899 www.nist.gov	(301) 975-2000

OSHA	Occupational Safety and Health Administration (U.S. Department of Labor) 200 Constitution Ave., NW Washington, DC 20210 www.osha.gov	(202) 219-8148
PS	Product Standard of NBS (U.S. Department of Commerce) Government Printing Office Washington, DC 20402 For product standards, contact: Ms. Brenda Umberger CS & PS Specialist c/o NIST Gaithersburg, MD 20899 www.nist.gov	(202) 512-1800 (301) 975-4036
RUS	Rural Utilities Service (Formerly: Rural Electrification Administration) (U.S. Department of Agriculture) 14th St. and Independence Ave., SW Washington, DC 20250	(202) 692-0187
TRB	Transportation Research Board, National Research Council 2101 Constitution Ave., NW Washington, DC 20418 www.nas.edu/trb	(202) 334-2934
USDA	U.S. Department of Agriculture 14th St. and Independence Ave., SW Washington, DC 20250 www.usda.gov	(202) 720-8732
USPS	U.S. Postal Service 475 L'Enfant Plaza, SW Washington, DC 20260-0010 www.usps.gov	(202) 268-2000

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

(Not Applicable)

END OF SECTION

SECTION 015000 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the construction facilities and temporary controls as shown on the drawings and specified herein, including but not limited to, the following:

1. Construction sign.
2. Hoists, stairs, and ladders.
3. Rodent control.
4. Temporary elevator.
5. Construction fence.
6. Field office.
7. Fire protection.
8. Temporary utilities.
9. Temporary toilets.
10. Temporary site access.
11. Security.
12. Water and snow control.
13. Environmental controls.

1.3 RELATED SECTIONS

A. Materials and equipment - Section 016000.

PART 2 PRODUCTS

2.1 GENERAL

A. Arrange for and provide temporary facilities and controls as specified herein and as required for the proper and expeditious prosecution of the work. Pay all costs, except as otherwise specified, until final acceptance of the work unless the Owner makes arrangements for the use of completed portions of the work after substantial completion.

B. Make all temporary connections to utilities and services in locations acceptable to the local authorities having jurisdiction thereof; furnish all necessary labor and materials, and make all installations in a manner subject to the acceptance of such authorities; maintain such connections; remove the temporary installation and connections when no longer required; restore the services and sources of supply to proper operating condition.

C. Unless otherwise noted, pay all costs for temporary electrical power, temporary water, and temporary heating; provide metering as necessary.

2.2 PROJECT IDENTIFICATION

A. No signs or advertisements will be allowed to be displayed on the premises without the approval of the Architect.

B. One construction sign on the site shall be provided by the Contractor and shall be subject to the review of the Architect and the approval of the Owner. Text and lettering shall be provided for at a later date.

C. Erect the construction sign on the site where directed by the Architect approximately 4 ft. x 8 ft. in size, of 3/4 in. plywood with suitable frame, moldings, and supports. Use Douglas Fir Overlaid Plywood, Grade B-B high density, exterior, good two sides, complying with PS-1. The sign shall be primed and given two coats of approved white paint. Lettering shall be black of an type, size, and lay-out as directed by the Owner. Sign shall contain the name of the building, Owner, Architect, Contractor, and such other reasonable information as the Architect or Owner may require.

2.3 MATERIAL HOIST

A. Provide a material hoist as required for use by all trades. Provide all necessary guards, signals, safety devices, and so on, required for safe operations, and suitable runways from the hoists to each floor level and roof. The construction and operation of the material hoist shall comply with all applicable requirements of ANSI A10.5, the ACG Manual of Accident Prevention in Construction and to all applicable state and municipal codes. Prohibit the use of the material hoist for transporting personnel.

2.4 RODENT CONTROL

A. Institute an effective program of rodent control for the entire site within the construction limits. Cooperate with local authorities and provide the regular services of an experienced exterminator who shall visit the site at least once a month for the entire construction period. Provide marked metal containers for all edible rubbish and enforce their use by all employees. Containers shall be emptied and the contents removed from the site as often as required to maintain an adequate rodent control program. If the program of rodent control used is not effective, take whatever steps are necessary to rid the project of rodents, and such action shall not be the basis of a claim for additional compensation or damages.

2.5 TEMPORARY CONSTRUCTION OPENINGS

A. Provide openings in slabs, walls, and partitions where required for moving in large pieces of equipment of all types. Close and/or restore all openings and finish them after the equipment is in place. Structural modification, if required, shall be subject to review by the Architect.

2.6 TEMPORARY ELEVATOR

A. Provide a temporary elevator for necessary service during construction operations after the hoistway enclosures are completed and electrical power is available; use temporary machines, or at the Contractor's option, use permanent machines, if they are available in due time for the required services.

B. The temporary elevator shall include temporary wood cars with suitable gates, including temporary hoistway doors, all designed in accordance with the local and state safety requirements.

C. The temporary services shall include qualified operating and maintenance personnel to perform the work in connection with the temporary operations.

D. Upon completion of temporary use, all work or damaged permanent parts are to be replaced and all equipment placed in first-class condition equal to new.

2.7 TEMPORARY FENCE

A. Provide and maintain an 8 foot high temporary fence to enclose the area at the job site and to guard and close effectively the designated area. Provide gates at locations where required for access to the enclosed area. Gates shall be cross-braced, hung on heavy strap hinges, and shall have hasps and padlocks. Paint the fence with two coats of an approved paint.

B. Remove the fence upon completion of the work or at such time before final completion as directed by the Owner.

2.8 TEMPORARY FIELD OFFICES

A. Provide and maintain a field office at the job site. The office shall be complete with light, heat, air conditioning, toilet facilities, electric water cooler, plan racks, four-drawer metal file with lock, shelves for samples, tables, chairs, and janitor service. When it becomes possible to establish an office in the building, office accommodation of approximately the same size as those in the field offices, including the services above, shall be provided and maintained until the issuance of a certificate of substantial completion. Temporary offices shall be removed when no longer required. Provide a telephone, computer with E-mail service and a fax line with machine and pay all charges for installation and calls, including long distance calls.

2.9 FIRE PROTECTION

A. Provide and maintain adequate fire protection, ready for instant use, distributed around the project.

B. Make arrangements for periodical inspection by New York City fire protection authorities and insurance underwriters inspections. Cooperate with said authorities and promptly carry out their recommendations.

C. Open fire will not be permitted within the building enclosure or on the project site.

2.10 TEMPORARY HEAT AND VENTILATION

A. Provide temporary heat as required during construction to protect the work from freezing or frost damage, and as necessary to ensure suitable working conditions for

the construction operations of all trades. In areas of the building where work is being conducted, the temperature shall be maintained as specified in the various sections of the Specifications, but not less than 45 degrees Fahrenheit. Under no circumstances shall the temperature be allowed to reach a level that will cause damage to any portion of the work which may be subject to damage by low temperatures.

B. Until the building, or any major portion thereof, is enclosed, temporary heating shall be by smokeless portable unit heaters of type listed by Underwriter's Laboratories, Factory Mutual, and the Fire Marshall. Pay for fuel, maintenance, and attendants required in connection with the portable unit heaters. Interior or exterior surfaces damaged by the use of these space heaters shall be replaced by new materials or be refinished.

C. The building shall be considered enclosed when it has reached the stage when exterior walls have been erected, the roof substantially completed, exterior openings closed up either by the permanently glazed windows and doors, or by adequate temporary closing, and the building is ready for interior masonry and plastering operations.

D. After the building, or any major portion thereof, has been enclosed, the permanent heating system as specified below may be used for temporary heat.

E. When the permanent heating system, or a suitable portion thereof, is in operating condition, the system may be used for temporary heating, provided that the Contractor assumes full responsibility for the entire heating system, and pays all costs for fuel, operation, maintenance, and restoration of the system.

F. Provide adequate ventilation as required to keep the temperature of the building within 10 degrees Fahrenheit of the ambient outdoor temperature when such ambient temperature exceeds 70 degrees Fahrenheit, and to prevent accumulation of excess moisture or to prevent excess thermal movement in the building.

G. When the permanent air circulation system, or a suitable portion thereof, is in operating condition, it may be used without refrigeration or chilling, provided that the Contractor assumes full responsibility for the system which he is using, and pays costs for power, operation, maintenance, and restoration of the system. Provide temporary filters to adequately filter air being distributed through the duct work to the supply outlets; disposable filters shall be placed in front of all exhaust registers to keep construction dirt out of exhaust duct work. The Contractor shall thoroughly clean the interior of the air handling units and duct work prior to acceptance of the work.

H. Upon conclusion of the temporary heating period, remove all temporary piping, temporary heating units, or other equipment and pay all costs in connection with repairing any damage caused by the installation or removal of temporary heating equipment. Thoroughly clean and recondition those parts of permanent heating and air circulation systems used for temporary service.

2.11 TEMPORARY LIGHT AND POWER

A. Make all arrangements with the local electric company for temporary electrical service to the construction site; provide all equipment necessary for temporary power and lighting; and pay all charges for this equipment, the installation thereof, and for current used. The electrical service shall be of 120v and 240v for single phase loads up to 30 amps for all construction tools and equipment without overloading the temporary facilities and shall be made available for power, lighting, and construction operations of all trades.

B. In addition to the electrical service, provide power distribution as required throughout structure. The terminations of power distribution shall be at convenient locations in the building. Terminations shall be provided for each voltage supply complete with circuit breakers, disconnect switches, and other electrical devices as required to protect the power supply system.

1. Provide double duplex outlets at not more than 200' o.c. both directions throughout this building.

C. A temporary lighting system shall be furnished, installed, and maintained as required to satisfy minimum requirements of safety and security. The temporary lighting system shall afford general illumination in all building areas and shall supply not less than 150 watt lamps on 30' centers both directions of floor area for illumination in the areas of the building where work is being performed.

D. All temporary equipment and wiring for power and lighting shall be in accordance with the applicable provisions of the governing codes. All temporary wiring shall be maintained in a safe manner and used so as not to constitute a hazard to persons or property.

E. When the permanent electrical power and lighting systems are in operating condition, they may be used for temporary power and lighting for construction purposes, provided that the Contractor assumes full responsibility for the entire power and lighting system, and pays costs for power, operations, maintenance, and restoration of the system.

2.12 TEMPORARY ROADS AND ACCESS TO SITE

A. Construct and maintain in good usable condition all required temporary roads and access to site, and, when no longer required, remove all temporary construction and restore the site.

B. Where streets now in use are within or adjacent to the work, keep the passageways of such streets open to vehicular and pedestrian traffic to building fronting thereon. Maintain constant access for police, fire and ambulance service.

C. Mud carried off the site and into public roads shall be removed immediately by the Contractor.

D. Access to the site for delivery of construction material or equipment shall be made only from locations designated by the Architect.

2.13 TEMPORARY STAIRS, LADDERS, RAMPS, SIDEWALK BRIDGING AND RUNWAYS

A. Provide and maintain all equipment such as temporary stairs, ladders, ramps, runways, and chutes as required for the proper execution of the work.

B. All such apparatus, equipment, and construction shall meet all requirements of the Labor Law and other state or local laws applicable thereto.

C. As soon as permanent stairs are erected, provide temporary protective treads, handrails, and shaft protection.

D. Covered Walkway: Erect a structurally adequate, protective, covered walkway for passage of persons along adjacent public street. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.

1. Construct covered walkways using scaffold or shoring framing.

2. Provide wood plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well drained walkways, and similar provisions for protection and safe passage.

3. Extend back wall beyond the structure to complete enclosure fence.

4. Paint and maintain in a manner approved by Owner and Architect.

5. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8" thick exterior plywood.

2.14 TEMPORARY TOILETS

A. Provide and maintain in a sanitary condition enclosed weathertight toilets for the use of all construction personnel at a location within the contract limits. Upon completion of the work, toilets shall be removed. Installation shall be in accordance with all applicable codes and regulations of authorities having jurisdiction. The number of toilet rooms required shall be in accordance with the ANSI Standard Safety Code for Building Construction or other local authorities.

2.15 TEMPORARY WATER SERVICE

A. Provide at a point within 10 feet of the building (or buildings) all water necessary for construction purposes. Make all temporary connections to existing mains; provide temporary meter; and make arrangements to pay for the temporary water service including cost of installation, maintenance thereof, and water used.

B. Furnish drinking water with suitable containers and cups for use of employees. Drinking water dispensers shall be conveniently located in the building where work is in progress.

C. When the permanent water supply and distribution system has been installed, it may be used as a source of water for construction purposes, provided that the Contractor assumes full responsibility for the entire water distribution system, and pays costs for operation, maintenance, and restoration of the system including the cost of water used.

D. At the completion of the construction work or at such time after the Contractor makes use of the permanent water installation, all temporary water service equipment and piping shall be removed, and all worn or damaged parts of the permanent system shall be replaced and equipment placed in first class condition equal to new.

2.16 SECURITY

A. Provide sufficient watchman service to prevent illegal entry or damage during nights, holidays, or other periods when work is not being executed, and such other control watchmen as required during working hours.

B. Provide all temporary enclosures required for protecting the project from the exterior, for providing passageways, for the protection of openings both exterior and interior, and any other location where temporary enclosures and protection may be required.

C. Take adequate precautions against fire; keep flammable material at an absolute minimum; and ensure that such material is properly handled and stored. Except as otherwise provided herein, do not permit fires to be built or open salamanders to be used in any part of the work.

2.17 WATER AND SNOW CONTROL

A. From the commencement to the construction of the completion of the work, keep all parts of the site and the project free from accumulation of water, and supply, maintain, and operate all necessary pumping and bailing equipment.

B. Remove snow and ice as necessary for the protection and prosecution of the work, and protect the work against weather damage.

C. The Contractor shall take over responsibility for site drainage upon entering the premises and shall maintain such drainage until completion of the work so as not to adversely affect the adjacent areas.

2.18 ENVIRONMENTAL CONTROLS

A. The Contractor shall comply with all applicable Federal, State and local laws, regulations, ordinances, codes and standards concerning environment control. Particular attention shall be given, without limitations, to:

1. Minimization of dust, containment of chemical vapors, control of engine exhaust gases, and control of smoke from temporary heaters.

2. Reduction of water pollution by control of sanitary facilities, proper storage of fuels and other potential contaminants, and prevention of siltation from land erosion.

3. Minimization of noise levels.

4. Proper and legal disposal, off site unless otherwise provided, of waste and spoil resulting from construction activities.

PART 3 EXECUTION

3.1 REMOVAL

A. Maintain all temporary facilities and controls as long as needed for the safe and proper completion of the work. Remove all such temporary facilities and controls as rapidly as progress of the work will permit or as directed by the Architect.

END OF SECTION

SECTION 015700 - TRAFFIC REGULATION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the traffic regulation as specified herein, as follows:

1. Flagmen.
2. Flares and Lights.
3. Haul Routes.
4. Traffic Signs and Signals.
5. Removal.

1.3 RELATED SECTIONS

A. Construction facilities and temporary controls - Section 015000.

1.4 SIGNS, SIGNALS, AND DEVICES

A. Post Mounted and Wall Mounted Traffic Control and Information Signs.

B. Traffic Control Signals: As approved by local jurisdictions.

C. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.

D. Flagmen Equipment: As approved by local jurisdictions.

1.5 FLAGMEN

A. Provide trained and equipped flagmen to regulate traffic when construction operations or traffic encroach on public traffic lanes.

1.6 FLARES AND LIGHTS

A. Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

1.7 HAUL ROUTES

A. Consult with authority having jurisdiction in establishing public thoroughfares to be used for haul routes and site access.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

1.8 TRAFFIC SIGNS AND SIGNALS

A. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.

B. Install and operate traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control, and areas affected by Contractor's operations.

C. Relocate as Work progresses, to maintain effective traffic control.

1.9 REMOVAL

A. Remove equipment and devices when no longer required.

B. Repair damage caused by installation.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

(Not Applicable)

END OF SECTION

SECTION 016000 - MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete materials, and equipment requirements as specified herein, including but not limited to, the following:

1. Transportation and handling.
2. Storage and protection.
3. Installation requirements.
4. Identifying markings.
5. Temporary use of equipment.
6. General standards.

1.3 RELATED SECTIONS

A. Product options and substitutions – Section 016300.

1.4 TRANSPORTATION AND HANDLING

A. Materials, products, and equipment shall be properly containerized, packaged, boxed, and protected to prevent damage during transportation and handling.

B. More detailed requirements for transportation and handling are specified under the technical Sections.

1.5 STORAGE AND PROTECTION

A. Provide suitable temporary weathertight storage facilities as may be required for materials that will be damaged by storage in the open.

B. Available storage space at the job site is limited to the area permitted by the Architect. Allocate such space for storage purposes. Any additional off-site space required is the responsibility of the Contractor.

C. Allocate the available storage areas and coordinate their use by the trades on the job. Maintain a current layout of all storage facilities.

D. Store and protect materials delivered at the site from damage. Do not use damaged material on the work.

1.6 INSTALLATION REQUIREMENTS

A. Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned as directed by the respective manufacturers, unless otherwise specified.

1.7 IDENTIFYING MARKINGS

A. Name plates and other identifying markings shall not be affixed on exposed surfaces of manufactured items installed in finished spaces.

1.8 TEMPORARY USE OF EQUIPMENT

A. No equipment intended for permanent installation shall be operated for temporary purposes without the written permission of the Architect.

B. The temporary or trial usage by the Owner of any mechanical device, machinery, apparatus, equipment or any work or materials supplied under this Contract before final completion and written acceptance by the Architect, shall not be construed as evidence of the acceptance of same by the Owner. The Owner shall have the privilege of such temporary and trial usage, for such reasonable length of time as and when the Architect shall deem to be proper for making a complete and thorough test of same and no claim for damage shall be made by the Contractor for the injury to or breaking of parts of such work which may be caused by weakness of inaccuracy of structural parts or by defective material or workmanship. If the Contractor so elects, he may at his own expense, place a competent person or persons to make such trial usage; such trial usage shall be under the supervision of the Contractor.

1.9 GENERAL REQUIREMENTS

A. In the event that it is necessary for the Contractor to store any materials offsite, he shall first obtain the approval of the Architect. The Contractor shall be responsible for insurance and warehousing charges of any materials stored offsite. The Contractor shall also be responsible for the cost of delivery to the job site of any materials that has been stored offsite.

B. Materials delivered to the job site shall be carefully stored and protected from damage. Damaged material shall not be used in the work. The Contractor shall provide, where directed temporary storage facilities as may be required for the storage of all materials which might be damaged by weather.

C. Manufactured articles, materials and equipment shall be applied installed, connected, erected, used, cleaned and conditioned as directed by the representative manufacturers, unless otherwise specified.

D. Equipment, plant, and appliances, such as hoists, centering, concrete lifts, construction elevators, cranes, rigging, towers, derricks, walks, ramps, chutes, scaffolding, implements, transportation, cartage and other things necessary and required for the adequate execution of the work and as required by law and applicable Union rules shall be provided and shall be maintained in good and safe mechanical working order, be responsible for their safe use, and remove them when no longer required. Applicable requirements of OSHA shall become and form a part of this document.

E. During handling and installation of work at project site clean and protect work in progress and adjoining work on a basis of perpetual maintenance. Apply suitable protective covering on newly installed work where reasonably required to ensure freedom from damage or deterioration at time of substantial completion; otherwise, clean and perform maintenance on newly installed work as frequently as necessary through remainder of construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

F. To extent possible through reasonable control and protection methods, supervise performance of work in a manner and by means which will ensure that none of the work whether completed or in progress, will be subjected to harmful, dangerous, damaging, or otherwise deleterious exposures during construction period. Such exposures include (where applicable, but not by way of limitation) static loading, dynamic loading, internal pressures, external pressures, high or low temperatures, thermal shock, high or low humidity, air contamination or pollution, water, ice, solvents, chemicals, light, radiation, puncture, abrasion, heavy traffic, soiling, bacteria, insect infestation, combustion, electrical current, high speed operation, improper lubrication, unusual wear, misuse, incompatible interface, destructive testing, misalignment, excessive weathering, unprotected storage, improper shipping/handling, theft and vandalism.

G. Require installer of each major unit of work to inspect substrate to receive the work, and conditions under which the work will be performed, and to report (in writing to Contractor) unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

H. Where installations include manufactured products, comply with manufacturer's applicable instructions and recommendations for installation to whatever extent these are more explicit or more stringent than applicable requirements indicated in the Contract Documents.

I. Inspect each item of materials or equipment immediately prior to installation and reject damaged and defective items.

J. Provide attachment and connection devices and methods for securing work properly as it is installed; true to line and level, and within recognized industry tolerance if not otherwise indicated. Allow for expansions and building movements. Provide uniform joint widths in exposed work, organized for best possible visual effect. Refer questionable visual-effect choices to Architect for final decision.

K. Recheck measurements and dimensions of the work as an integral step of starting each installation.

L. Install work during conditions of temperature, humidity, exposure, forecasted weather, and status of project completion which will ensure best possible results for each unit of work in coordination with entire work. Isolate each unit of work from non-compatible work, as required to prevent deterioration.

M. Coordinate enclosure (closing-in) of work with required inspections and tests, so as to avoid necessity of uncovering work for that purpose.

N. Mounting Heights: Except as otherwise indicated, mount individual units of work at industry-recognized standard mounting heights, for applications indicated. In CMU walls mount units at height closest to manufacturer's recommendation so as to minimize

cutting of block coursings. Refer questionable mounting height choices to Architect for final decision.

END OF SECTION

SECTION 016300 - PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLCUDES

A. Within 30 calendar days after the date of commencement of construction submit to Architect a complete list of major products which are proposed for substitution with name of manufacturer, trade name, and model.

B. List products by Specification Section number and title.

1.3 PRODUCT OPTIONS

A. Product Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers Followed by "or equal" or "or accepted equal": Submit a request for substitution for any manufacturer not named.

1.4 SUBSTITUTIONS

A. Substitutions which are equal in quality and utility to those specified will be acceptable, subject to the following provisions:

1. The Drawings or Specifications indicated "or equal" or "or accepted equal".

2. Action on substitutions by Architect will be in writing.

3. Contractor shall submit to Architect, within 10 calendar days after date of each Contract, a completed Substitution Request Form for each proposed substitute item or material.

4. Sufficient data, drawings, samples, tests, literature, or other detailed information as will demonstrate to Architect that the proposed substitute is not less than equal in quality and utility to the material specified. Any required revisions to any and all other items of work affected by the proposed substitution, including specific measures required to make such work conform to the proposed substitution shall be appended to this list. Arrange data to allow side by side review of pertinent characteristics.

5. Architect will accept, in writing, such proposed substitutions as are in his opinion the equivalent in quality and utility to the items or materials specified. Differences in color, finish, or general appearance will be grounds for rejection.

6. Architect's acceptance shall not relieve the Contractor from complying with the requirements of the Contract Documents, and the Contractor shall be responsible at his own expense for any changes resulting and subsequently becoming apparent from his proposed substitutions which affect other parts of his own work

or the work of other Contractors. Such changes will be subject to review and approval by the Architect for conformance to the Design Intent. Contractor shall bear the cost of any work required to maintain conformance to the Design Intent.

B. Failure to propose the substitution of any product within the 10 day period may be deemed sufficient cause for the denial of the request for substitution.

C. Substitutions submitted by the Contractor for any material, product, or equipment for that specified may be subject to such tests as will determine its quality relative to fire ratings or class ratings and other qualities.

1. Handling, testing, and inspection costs pertaining thereto shall be paid by the Contractor.

2. All such tests shall be made upon the request of the Contractor and Owner.

D. Contractor making a substitution shall pay for any added costs caused by the substitution.

E. Architect may require the Contractor to furnish at the Contractor's expense a special performance guarantee or other surety with respect to any substitution.

F. Architect may require the Contractor to furnish at the Contractor's expense additional data about the proposed substitute.

G. A request constitutes a representation that the Contractor:

1. Has investigated proposed product and determined that it meets or exceed the quality level of the specified product.

2. Will provide the same warranty or bond for the proposed substitution as for the specified product.

3. Will coordinate installation and make changes to other work which may be required for the work to be complete in accordance with the Contract Documents and applicable regulatory requirements with no additional cost to the Owner.

4. Waives claims for additional costs or time extension associated with the substitution, which may subsequently become apparent.

5. Will pay costs of changes to Contract Documents required by accepted substitutions.

6. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

H. Substitutions will not be considered for the following:

1. When they are indicated or implied on shop drawings or product data submittals.

2. Are requested directly by a subcontractor or supplier.

3. Are without separate written request.

4. Acceptance will require substantial revision to Contract Documents.

I. Substitute products shall not be ordered without written acceptance of Architect.

J. Architect will determine the acceptability of proposed substitutions and reserves the right to reject proposals due to insufficient information.

K. Substitutions required by inability to obtain materials specified will not be acceptable grounds for increase in Contract Sum or time of completion of Contract.

L. Rejection of substitutions shall not be grounds for increase in Contract Sum or time of completion of Contract.

M. Rejection of substitutions is final, unless the Architect explicitly indicates otherwise.

N. In the event of monetary benefit from an accepted substitution, the Owner will receive 100% credit.

END OF SECTION

SECTION 017300 - EXECUTION REQUIREMENTS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.

2. Field engineering and surveying.

3. General installation of products.

4. Progress cleaning.

5. Starting and adjusting.

6. Protection of installed construction.

7. Correction of the Work.

1.3 RELATED SECTIONS

A. Cutting and patching – Section 017329.

B. Closeout procedures – Section 017700.

1.4 SUBMITTALS

A. Qualification Data: For land surveyor to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

D. Certified Surveys: Submit two copies signed by land surveyor.

E. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: Before beginning site work, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.

2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

a. Description of the Work.
b. List of detrimental conditions, including substrates.
c. List of unacceptable installation tolerances.
d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.

4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

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

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

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 CONSTRUCTION LAYOUT

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

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.

2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.

3. Inform installers of lines and levels to which they must comply.

4. Check the location, level and plumb, of every major element as the Work progresses.

5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.

6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for

mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.

2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.

3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site work.

D. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.

2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.

3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.

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

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

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

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

F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.

2. Allow for building movement, including thermal expansion and contraction.

G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

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

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg. F.

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.

2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

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

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION

SECTION 017329 - CUTTING AND PATCHING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. This Section includes procedural requirements for cutting and patching.

1.3 RELATED SECTIONS

A. Refer to Divisions 2 through 33 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1. Requirements in this Section apply to mechanical and electrical installations. Refer to Divisions 23 and 26 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.4 DEFINITIONS

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

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

1.5 SUBMITTALS

A. Cutting and Patching: Submit a method describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.

2. Changes to In Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.

3. Products: List products to be used and firms or entities that will perform the Work.

4. Dates: Indicate when cutting and patching will be performed.

5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.

7. Architect's Approval: Obtain approval of cutting and patching before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.6 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

1. Provide a list of additional elements that are structural elements and that require Architect's or Construction Manager's approval of a cutting and patching proposal.

B. Operational Elements: Do not cut and patch the following operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

1. Primary operational systems and equipment.

2. Air or smoke barriers.

3. Fire-protection systems.

4. Control systems.

5. Communication systems.

6. Conveying systems.

7. Electrical wiring systems.

8. Operating systems of special construction in Division 13 Sections.

C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

1. Water, moisture, or vapor barriers.

2. Membranes and flashings.

3. Exterior curtain-wall construction.

4. Equipment supports.

5. Piping, ductwork, vessels, and equipment.

6. Noise- and vibration-control elements and systems.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.7 WARRANTY

A. Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void warranties.

PART 2 PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. In Place Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in place materials.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size

required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. In Place Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.

5. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

   a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

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

1. Inspection procedures.

2. Project Record Documents.

3. Warranties.

4. Instruction of Owner's personnel.

5. Final cleaning.

1.3 RELATED SECTIONS

A. Execution requirements – Section 017300.

B. Operating and maintenance data – Section 017823.

1.4 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.

2. Advise Owner of pending insurance changeover requirements.

3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs and photographic negatives, damage or settlement surveys, property surveys, and similar final record information.

6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.

7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.

8. Complete startup testing of systems.

9. Submit test/adjust/balance records.

10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.

11. Advise Owner of changeover in heat and other utilities.

12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

13. Complete final cleaning requirements, including touchup painting.

14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

2. Results of completed inspection will form the basis of requirements for Final Completion.

1.5 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment.

2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

4. Submit pest-control final inspection report and warranty.

5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled

requirements. Architect will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

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

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.

2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of Architect.
d. Name of Contractor.
e. Page number.

1.7 PROJECT RECORD DOCUMENTS

A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.

1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
b. Accurately record information in an understandable drawing technique.
c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.

2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.

3. Mark important additional information that was either shown schematically or omitted from original Drawings.

4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.

5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

3. Note related Change Orders, Record Drawings and Product Data, where applicable.

D. Record Product Data: Submit one copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.

3. Note related Change Orders, Record Drawings and Record Specifications, where applicable.

E. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.8 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2” x 11” paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 EXECUTION

3.1 DEMONSTRATION AND TRAINING

A. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Provide instructors experienced in operation and maintenance procedures.

2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.

3. Schedule training with Owner with at least seven days' advance notice.

4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.

B. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:

1. System design and operational philosophy.

2. Review of documentation.

3. Operations.

4. Adjustments.

5. Troubleshooting.

6. Maintenance.

7. Repair.

3.2 FINAL CLEANING

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

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to unusual operating conditions.

o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean ducts, blowers, and coils if units were operated without filters during construction.
r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
s. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION

SECTION 017823 - OPERATING AND MAINTENANCE DATA

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 SECTION INCLUDES

A. Work of this Section includes all labor, materials, equipment and services necessary to complete the operating and maintenance data as specified herein.

1.3 RELATED SECTIONS

A. Submittals - Section 013300.

B. Contract closeout - Section 017000.

1.4 GENERAL

A. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under the Contract.

1. Sub-Contractors shall prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of Specifications.

1.5 FORM OF SUBMITTALS

A. Prepare data in the form of an instructional manual for use by Owner's personnel.

B. Format

1. Size: 8-1/2 x 11 in.

2. Paper: 20 pound minimum, white for typed pages.

3. Text: Manufacturer's printed data, or neatly typewritten.

4. Drawings

a. Provide reinforced punched binder tab, bind in with text.
b. Fold larger drawings to the size of the text pages.

5. Provide fly-leaf for each separate product, or each piece of operating equipment.

a. Provide typed description of product, and major component parts of equipment.
b. Provide indexed tabs.

6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:

a. Title of Project.

b. Identity of separate structure as applicable.
c. Identity of general subject matter covered in the manual.

C. Binders

1. Commercial quality three-ring binders with durable and cleanable plastic covers.

2. Maximum ring size: 1 inch.

3. When multiple binders are used, correlate the data into related consistent groupings.

1.6 MANUAL FOR MATERIALS AND FINISHES

A. Submit two copies of complete manual in final form.

B. Content, for architectural products, applied materials and finishes

1. Manufacturer's data, giving full information on products.

a. Catalog number, size, composition.
b. Color and texture designations.
c. Information required for re-ordering special-manufactured products.

2. Instructions for care and maintenance.

a. Manufacturer's recommendation for types of cleaning agents and methods.
b. Cautions against cleaning agents and methods which are detrimental to the product.
c. Recommended schedule for cleaning and maintenance.

C. Content, for moisture-protection and weather-exposed products

1. Manufacturer's data, giving full information on products.

a. Applicable standards.
b. Chemical composition.
c. Details of installation.

2. Instructions for inspection, maintenance, and repair.

1.7 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit three copies of complete manual in final form.

B. Content, for each unit of equipment and system, as appropriate.

1. Description of unit and component parts.

   a. Function, normal operating characteristics, and limiting conditions.
   b. Performance curves, engineering data and tests.
   c. Complete nomenclature and commercial number of all replaceable parts.

2. Operating procedures

   a. Start-up, break-in, routine and normal operating instructions.
   b. Regulation, control, stopping, shut-down and emergency instructions.
   c. Summer and winter operating instructions.
   d. Special operating instructions.

3. Maintenance procedures

   a. Routine operations.
   b. Guide to "trouble-shooting".
   c. Disassembly, repair and reassembly.
   d. Alignment, adjusting and checking.

4. Servicing and lubrication schedule.

   a. List of lubricants required.

5. Manufacturer's printed operating and maintenance instructions.

6. Description of sequence of operation by control manufacturer.

7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.

   a. Predicted life of parts subject to wear.
   b. Items recommended to be stocked as spare parts.

8. As-installed control diagrams by controls manufacturer.

9. Each contractor's coordination drawings.

   a. As-installed color coded piping diagrams.

10. Charts of valve tag numbers, with the location and function of each valve.

11. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

12. Other data as required under pertinent sections of specifications.

C. Content, for each electric and electronic system, as appropriate:

1. Description of system and component parts.

   a. Function, normal operating characteristics, and limiting condition.
   b. Performance curves, engineering data and tests.

c. Complete nomenclature and commercial number of replaceable parts.

2. Circuit directories of panel boards.

   a. Electrical service.
   b. Controls.
   c. Communications.

3. As-installed color coded wiring diagrams.

4. Operating procedures

   a. Routine and normal operating instructions.
   b. Sequences required.
   c. Special operating instructions.

5. Maintenance procedures

   a. Routine operations.
   b. Guide to "trouble-shooting".
   c. Disassembly, repair and reassembly.
   d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.

7. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

8. Other data as required under pertinent sections of specifications.

D. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.

E. Additional requirements for operating and maintenance data: The respective sections of Specifications.

END OF SECTION

SECTION 018115 - CONSTRUCTION WASTE MANAGEMENT

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. All sections of the Specifications involving demolition or construction activities.

1.3 SUMMARY

A. This Section includes requirements for Construction Waste Management (CWM), with criteria for recycling and/or salvaging demolition and construction waste generated during the project. A Construction Waste Management Plan shall be developed for approval by the Owner and Architect. The Plan shall be implemented throughout the duration of the project, and shall be documented per the Submittal Requirements of this Section. Construction Waste Management is included as part of the LEED Building requirements for the project.

1.4 PROJECT WASTE MANAGEMENT REQUIREMENTS

A. The Owner has established that this Project shall generate the least amount of waste possible, and that processes that ensure the generation of as little waste as possible due to error, inaccurate planning, breakage, mishandling, contamination, or other factors shall be employed.

B. Of the inevitable waste that is generated, as many of the waste materials as economically feasible shall be returned, reused, salvaged, or recycled. Waste disposal in landfills shall be minimized.

C. Diversion Requirements: The end-of-project recycling rate shall equal, at minimum, **75%** by weight of the total project waste from construction, demolition, and land clearing activities on site. Excavation soil and hazardous waste are excluded from the calculation.

D. Due to the nature and location of the Site, recycling on site may not be possible (to be determined by the Contractor). The Waste Contractor(s) should include off-site opportunities to recycle and reuse removed materials in the Construction Waste Management Plan.

E. As regards these requirements, the Contractor shall develop, for the Owner's review, a Construction Waste Management Plan for this project.

1.5 CONSTRUCTION WASTE MANAGEMENT PLAN

A. The Contractor shall prepare and submit a Construction Waste Management Plan (CWM) to the Owner and Architect for approval. The CWM Plan shall outline the provisions to be implemented to recycle and salvage demolition and construction waste generated during the project.

B. Upon approval of the CWM Plan by the Owner and Architect, it shall be implemented throughout the duration of the project, and documented in accordance with the Submittal Requirements of this Section.

C. The CWM Plan shall include, but not be limited to, the following components:

1. *Listing of Targeted Materials*: Develop a list of the waste materials from the Project that will be targeted for reuse, salvage, or recycling. The following materials shall be accounted for (materials that will not be recycled shall be indicated as such):

   a. Cardboard, paper, packaging.
   b. Clean dimensional wood, palette wood.
   c. Beverage containers.
   d. Land clearing debris.
   e. Concrete.
   f. Concrete Masonry Units (CMU).
   g. Asphalt.
   h. Metals from banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
   i. Drywall.
   j. Carpet and pad.
   k. Paint.
   l. Rigid foam.
   m. Glass.
   n. Plastics.

2. *Landfill Information*: Provide the name of the landfill(s) where trash will be disposed of and the applicable landfill tipping fee(s).

3. *Sorting Method*: Provide a description of the proposed means of sorting and transporting the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site for off-site sorting).

4. *Packaging Waste*: Provide an estimate of packaging materials generated, and note whether suppliers will eliminate or take back packaging.

5. *Field Conditions:* Include provisions in the Construction Waste Management Plan for addressing conditions in the field that do not adhere to the CWM Plan, including provisions to implement a stop work order, or to rectify non-compliant conditions.

6. *Recycling Facilities:* Provide the name of the recycling facilities(s) where materials will be sent for recycling, how it will be recycled, and the applicable fee(s).

7. *Additional Information:* Include any additional information deemed relevant to describe the scope and intent of the CWM Plan to the Owner and Architect.

D. Subcontractor Requirements: Construction Waste Management and recycling requirements shall be incorporated into all Subcontractor's contracts.

1.6 SUBMITTAL REQUIREMENTS

A. The Contractor and/or Subcontractors shall submit the following LEED BUILDING certification items:

1. A copy of the Construction Waste Management Plan.

2. Calculations and supporting documentation to demonstrate end-of–project recycling rates which meet the requirements of the Construction Waste Management Plan of this Section.

B. Monthly Reporting: The process for recording and assembling documentation shall be as follows:

1. Record and document the total weight (in tons) of all demolition and construction waste materials sent to the landfill. Monthly Waste Management Reporting Forms shall be used as the basis for determining the total amount of waste land filled for the project. The monthly reporting forms shall specify:

   a. The number of Dumpsters or other containers sent to the landfill for that month;
   b. The volume (in cubic yards) of each Dumpster or container sent to the landfill for that month;
   c. The type of waste contained in each Dumpster or container, and the weight of the waste in each Dumpster or container. If the weight of the waste is not directly measured for each Dumpster or container, the following Solid Waste Conversion Factors shall be used to convert the volume of waste to weight:
      1). Solid Weight Conversion Factors:

Mixed Waste	350 lbs/cubic yard
Wood	300 lbs/cubic yard
Cardboard	100 lbs/cubic yard
Gypsum Wallboard	500 lbs/cubic yard
Rubble	1,400 lbs/cubic yard
Steel	1,000 lbs/cubic yard

   d. Identification of the Landfill: Provide the name of the landfill that will be accepting the materials. Receipts or other proof of facility reception of materials is required.

2. Record and document the total weight (in tons) of all demolition and construction waste materials recycled or salvaged. Monthly Waste Management Reporting Forms shall be used as the basis for determining the total amount of waste recycled or salvaged for the project. The monthly reporting forms shall specify:

   a. The number of Dumpsters or other containers of recycled or salvaged materials for that month;
   b. The volume (in cubic yards) of each Dumpster or container of recycled or salvaged materials for that month;
   c. The type of recycled or salvaged material contained in each Dumpster or container; and
   d. The weight of the recycled or salvaged material in each Dumpster or container. If the weight of the material is not directly measured for each Dumpster or container, the Solid Waste Conversion Factors listed for landfill waste (see above) shall be used, where applicable, to convert the volume of material to weight. For materials not contained in the Solid Waste Conversion Factors above (e.g. glass), propose a conversion factor for review by the Owner and Architect.
   e. Provide the name of the receiving facilities/companies that will be purchasing or accepting the recycled or salvaged materials. Receipts or other proof of facility reception of materials is required.
   f. For materials separated for recycling off-site, establish a method for tracking the weight of the recycled material. The method shall be included in the CWM Plan for the Owner's and Architect's review and approval.

3. Calculate the end-of-project recycling rate percentage by dividing the recycled and salvaged waste (in tons) by the total waste generated (recycled, salvaged, and land filled waste – also in tons), and multiplying by 100.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

3.1 IMPLEMENTATION

A. The Contractor shall be responsible for coordination and implementation of the overall Construction Waste Management Plan, as well as coordination of the Plan with all affected trades.

B. The Contractor shall designate one individual as the on-site Construction Waste Management Representative, who will be responsible for communicating the progress of the Plan with the Owner and Architect on a regular basis, and for assembling the required LEED documentation.

C. The Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.

D. Separation Facilities: If waste sorting will be done on site, the Contractor shall lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.

3.2 MEETINGS

A. Conduct Construction Waste Management meetings. Meetings shall include Subcontractors affected by the CWM Plan. At a minimum, waste management goals and issues shall be discussed at the following meetings:

1. Pre-bid meeting.

2. Pre-construction meeting.

3. Regular job-site meetings.

B. Monthly Waste Management Reporting Forms: Monthly Waste Management Reporting Forms, as required in the Submittal Requirements of this Section, shall be submitted to the Owner and Architect for review throughout the duration of the project.

END OF SECTION

SECTION 018119 - CONSTRUCTION IAQ MANAGEMENT

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 CONSTRUCTION IAQ MANAGEMENT GOALS FOR THE PROJECT

A. The Owner has established that this Project shall minimize the detrimental impacts on Indoor Air Quality (IAQ) resulting from construction activities. Factors that contaminate indoor air, such as dust entering HVAC systems and ductwork, improper storage of materials on site, and poor housekeeping, shall be minimized.

1.3 SUMMARY

A. This Section includes requirements for the development of a Construction Indoor Air Quality Management Plan.

1. Management Plan (referred to as “the Plan”): Develop the Plan for approval by the Owner and Architect. The Plan shall be implemented throughout the duration of the project construction and before occupancy, and shall be documented as outlined in the Submittal Requirements of this Section. The Plan is included as part of the LEED Building requirements for the project (EQ Credits 3.1 and 3.2).

1.4 RELATED SECTIONS

A. All sections of the Specifications related to interior construction, MEP systems, and items affecting indoor air quality.

B. Volatile Organic Compound (VOC) Limits For Adhesives, Sealants & Architectural Coatings - Section 018119.

C. Painting - Section 099000.

1.5 DEFINITIONS

A. Volatile Organic Compounds (VOCs): Chemical compounds common in and emitted by many building products, including solvents in paints, coatings, adhesives and sealants, wood preservatives; composite wood binder, and foam insulations. Not all VOCs are harmful, but many of those contained within building products contribute to the formation of smog and can irritate (or worse) building occupants by their smell and/or health impact.

B. Materials that Act as “Sinks” for VOC Contamination: Absorptive materials, typically dry and soft (such as textiles, carpeting, acoustical ceiling tiles and gypsum board) that readily absorb VOC’s emitted by “source” materials and release them over a prolonged period of time.

C. Materials that Act as “Sources” for VOC Contamination: Products with high VOC contents that emit VOCs either rapidly during application and curing (typically "wet"

products, such as paints, sealants, adhesives, caulks and sealers) or over a prolonged period (typically "dry" products such flooring coverings with plasticizers and engineered wood with formaldehyde).

1.6 REFERENCES

A. "IAQ Guidelines for Occupied Buildings Under Construction," First Edition, November 1995, Chapter 3; The Sheet Metal and Air Conditioner Contractors National Association (SMACNA), (703) 803-2980, www.smacna.org

B. ANSI/ASHRAE 52.2-1999, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," www.ashrae.org

1.7 CONSTRUCTION IAQ MANAGEMENT PLAN

A. The Contractor shall prepare and submit a Construction IAQ Management Plan to the Owner for approval. The Construction IAQ Management Plan shall meet the following criteria:

1. Construction activities shall be planned to meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors' Association (SMACNA) "IAQ Guidelines for Occupied Buildings under Construction," First Edition, 1995, Chapter 3.

2. Absorptive materials shall be protected from moisture damage when stored on site and after installation.

3. If air handlers are to be used during construction, filtration with a Minimum Efficiency Reporting Value (MERV) of 8 must be at each return air grill, as determined by ASHRAE 52.2-1999.

4. All filtration media shall be replaced immediately prior to occupancy. Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13 as determined by ASHRAE 52.2-1999.

5. A "Sequence of Finish Installation Plan" shall be developed, highlighting measures to reduce the absorption of VOCs by materials that act as "sinks."

B. Upon approval of the Plan by the Owner and Architect, it shall be implemented through the duration of the construction process and before occupancy, and documented in accordance with the Submittal Requirements of this Section.

C. Further description of the Construction IAQ Management Plan requirements is as follows:

1. SMACNA Guidelines: Chapter 3 of the referenced "IAQ Guidelines for Occupied Buildings Under Construction," outline IAQ measures in five categories as listed below. The Construction IAQ Management Plan shall be organized in accordance with the SMACNA format, and shall address measures to be implemented in each of the five categories (including subsections). All subsections shall be listed in the Plan; items that are not applicable for this project should be listed as such.

a. HVAC Protection
- Return Side

- Central Filtration
- Supply Side
- Duct Cleaning

b. Source Control
- Product Substitution
- Modifying Equipment Operation
- Changing Work Practices
- Local Exhaust
- Air Cleaning
- Cover or Seal

c. Pathway Interruption
- Depressurize Work Area
- Pressurize Occupied Space
- Erect Barriers to Contain Construction Areas
- Relocate Pollutant Sources
- Temporarily Seal the Building

d. Housekeeping

e. Scheduling
- Protect of Materials from Moisture Damage: As part of the "Housekeeping" section of the Construction IAQ Management Plan, measures to prevent installed materials or material stored on-site from moisture damage shall be described. This section should also describe measures to be taken if moisture damage does occur to absorptive materials during the course of construction.
- Replacement of Filtration Media: Under the "HVAC Protection" section of the Construction IAQ Management Plan, a description of the filtration media in all ventilation equipment shall be provided. The description shall include replacement criteria for filtration media during construction, and confirmation of filtration media replacement for all equipment immediately prior to occupancy.
- Sequence of Finish Installation for Materials: Where feasible, absorptive materials shall be installed after the installation of materials or finishes which have high short-term emissions of VOCs, formaldehyde, particulates, or other air-borne compounds.

  Absorptive materials include, but are not limited to: carpets; acoustical ceiling panels; fabric wall coverings; insulations (exposed to the airstream); upholstered furnishings; and other woven, fibrous or porous materials. Materials with high short-term emissions include, but are not limited to: adhesives, sealants and glazing compounds (specifically those with petrochemical vehicles or carriers); paints, wood preservatives and finishes; control and/or expansion joint fillers; hard finishes requiring adhesive installation; gypsum board (with associated finish processes and products); and composite or engineered wood products with formaldehyde binders.

  Pre-Occupancy Phase: Schedule a building flush-out by supplying air volume required by LEED Credit EQ3.2

  Develop a separate sequencing plan that identifies feasible opportunities to meet the above-stated goals for the project. The plan shall be submitted to the Architect and Owner in accordance with the Submittal Requirements of this Section.

1.8 LEED BUILDING SUBMITTALS

A. The Contractor shall submit the following LEED required records and documents:

1. A copy of the Construction IAQ Management Plan and the Sequence Installation Plan, as defined in this Section.

2. Product cut-sheets for all filtration media used during construction and installed immediately prior to occupancy, with MERV values highlighted. Cut sheets shall be submitted with the Contactor's or Subcontractor's 'approved' stamp as confirmation that the products are the products installed on the project.

3. Provide the Architect or Owner's Representative with a minimum of 18 photographs, comprised of at least six photographs taken on three different occasions during construction. The photographs shall document the implementation of the Construction IAQ Management Plan throughout the course of the project construction. Examples include photographs of ductwork sealing and protection, temporary ventilation measures, and conditions of on-site materials storage (to prevent moisture damage). Photographs shall include integral date stamping, and shall be submitted with brief descriptions of the Construction IAQ Management Plan measure documented, or be referenced to project meeting minutes or similar project documents which reference to the Construction IAQ Management Plan measure documented.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

3.1 IMPLEMENTATION AND COORDINATION

A. Implement the Construction IAQ Management Plan, and coordinate the Plan with all affected trades. Designate one individual as the Construction IAQ Representative, who will be responsible for communicating the progress of the Plan with the Owner and Architect on a regular basis, and for assembling the required LEED Building documentation. The Contractor shall include provisions in the Construction IAQ Management Plan for addressing conditions in the field that do not adhere to the Plan, including provisions to implement a stop work order, or to rectify non-compliant conditions.

B. Subcontractors shall be responsible for the implementation of specific control measures, as specified in the Construction IAQ Management Plan. Subcontractors shall coordinate their responsibilities through the Construction Manager and their designated Construction IAQ Representative.

END OF SECTION

SECTION 04400 - STONE CLADDING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 WORK INCLUDED

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the stone cladding as shown on the drawings and/or specified herein, including, but not limited to, the following:

1. Stone slabs at the LAND gallery including:

   a. Slate
   b. Limestone
   c. Granite
   d. Sandstone

2. Preparation and installation of Owner provided stone samples.

3. Anchors, dowels, cramps, bolts, nuts, threaded studs, expansion shields, inserts, loose clips, loose angles, struts, relieving angles, support angles, shims, steel frame supports, wire anchors, tape, and all other fastening devices and accessories necessary for complete setting and anchorage of stone facings to structural support.

4. Protection of stone during transit, storage, erection, and installation. Cleaning of stone prior to acceptance.

5. Structural design for the support of stone slabs by Exhibit Fabricator's Professional Engineer, including Building Department filing requirements.

1.3 RELATED SECTIONS

Section 05500 - Metal Fabrications

Section 10600 - Partition Systems

1.4 DOCUMENTATION

A. The drawings (elevation and design details) and specifications are an outline of the criteria and performance requirements of the work. The requirements shown by the drawings and details are intended to establish basic dimensions of the stone module and the seam lines and profiles. Within these parameters, the Exhibit Fabricator is responsible for the design and engineering of the system, including whatever modifications or additions may be required to meet the specified requirements and maintain the visual design concept and exhibit functionality for the entire work of this Section.

B. It is recognized that the design details do not cover every condition. It is, however, intended that any conditions not detailed shall be developed through the Exhibit

Fabricator's shop drawings to the same level of aesthetics and in compliance with performance criteria, as indicated for detailed areas and stipulated in these specifications. The Exhibit Fabricator, by accepting a contract for the work, acknowledges this and agrees that the Exhibit Designer shall have the final say as to all matters whether detailed or not on the design details.

1.5 QUALITY ASSURANCE

A. The Exhibit Fabricator, by commencing the work of this Section, assumes overall responsibility, as part of his warranty of the work, to assure that all assemblies, components and parts shown or required within the work of this Section, comply with the Contract Documents. The Exhibit Fabricator shall further warrant:

1. That all components, specified or required to satisfactorily complete the installation, are compatible with each other and with the conditions of installation and expected use.

2. The overall effective integration and correctness of individual parts and the whole of the system.

3. Compatibility with adjoining substrates, materials and work of other trades.

4. There shall be no premature material failure due to improper design and fabrication of the stone. All materials are to fully perform to their normal life expectancy.

5. Each and every piece of stone shall be subject to the Exhibit Designer's approval, and any piece or pieces which may be rejected after having been set shall be carefully cut out and replaced with new suitable stone without delay, and without cost. Any piece or pieces damaged in the removal and resetting of defective pieces shall also be removed, and suitable, approved pieces provided and set.

B. Examination Criteria: All examinations, selections and approvals shall be for the purpose of achieving a final appearance of stone with the greatest possible uniformity, and will be based upon the following criteria:

1. Color within approved, pre-selected color ranges and finish.

2. Sequence matching of adjacent stone units, as approved by the Exhibit Designer.

3. Performance criteria of the stone cladding as an interactive exhibit.

1.6 SUBMITTALS

A. Shop Drawings: Prior to construction of mock-up, submit shop drawings for the fabrication and installation of all work and associated components. Include:

1. Elevation at scale of 1”=1’-0”.

2. Details of mounting, connectors, and hardware at 3” = 1’-0”. Show details of all conditions for every member, joint, anchorage and provision for expansion and contraction and joint treatment.

3. Include coordination details for related and adjoining work, insert drawings and erection diagrams. Show relative layout for all adjacent walls, beams, columns and slabs, all correctly dimensioned.

B. Provide structural calculations, prepared by a Professional Engineer licensed in the State of Utah, prepared in compliance with referenced documents and these specifications. Calculations shall include the following information:

1. Analysis for all applicable loads on substrate.

2. Analysis for all applicable loads on anchors.

3. Analysis of stress in stone and required interactive performance and safety factors.

C. Safety factors required at anchor locations shall be 2.0 times the values noted above for the allowable stresses.

D. Review of calculations and shop drawings by the Exhibit Designer will not relieve the Exhibit fabricator of any responsibilities for providing a system within the required performance requirements. Calculations shall be signed and sealed by the Exhibit Fabricator's Engineer.

E. Manufacturer's Data

1. Submit copies of manufacturer's specifications and installation instructions for mounting hardware required. Include data substantiating that materials comply with specified requirements.

F. Samples

1. Submit samples of all materials and finishes and details. Samples include standard submission samples, visual mock-up samples, sample slabs, production samples, and additional samples as described below.

2. Samples shall demonstrate the complete range of visual properties of the material and finish as specified in PART 2 – MATERIALS. The single exposed surface grain, i.e. head, rift or lift, as proposed by the Exhibit Fabricator and approved by the Exhibit Designer.

3. Samples shall be the following sizes:

a. (3) Standard Submission Samples: 12" x 12" of each sample type.

4. Range Samples: None required.

1.7 FABRICATION AND ERECTION TOLERANCES

A. Tolerances are as follows:

1. All joints to adjacent materials shall be 1/2" wide.

2. Stone face dimension tolerance (flatness) shall be variable 1"-3" in depth.

3. Stone thickness tolerance shall be 1"-5".

B. Variation From Plumb: Stone slabs are 10" from vertical, variation should not exceed 1" in 5 ft. max.

1.8 PERFORMANCE REQUIREMENTS

A. Structural Requirements: The work, as erected, shall be designed to withstand a lateral force of 30 psf (or greater if required by Code) applied over field surface normal to face of stone. Deflection under this load shall be limited to L/360 or 3/8" whichever is less.

B. Interactivity: The forces applied to the stone by touching shall not damage the stone, force it out of alignment or otherwise loosen fasteners and connections.

C. Methods and fabrication and assembly (except as specified herein) shall be at the discretion of the Exhibit Fabricator provided that the visible design effect is not changed and the strength qualities, as demonstrated by engineering calculations are not reduced.

D. Remedial measures shall maintain standards of quality and durability and are subject to approval by the Exhibit Designer.

E. Anchors

1. Adequate number and size of anchors shall be provided to satisfy the load requirements and design criteria.

1.9 CODES AND STANDARDS

A. All work shall be performed in accordance with the prevailing Building Code, or the requirements of this Specification, whichever are more stringent.

B. Stone Cladding System shall conform to, but not be limited to, the following codes and standards:

1. National Building Granite Quarries Assoc. (NBGQA).

2. American National Standards Institute (ANSI). American National Standards Institute (ANSI).

3. American Society for Testing and Materials (ASTM).

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect stone during storage and construction against moisture, soiling, staining, and physical damage.

B. Handle stone to prevent chipping, breakage, soiling or other damage.

1.11 GUARANTEE

A. Unless stated otherwise in these Specifications, guarantee shall state that all work is in accord with Drawings and Specifications, as amended by any changes thereto authorized by the Exhibit Designer, free from defects in materials and workmanship for a period of five (5) years from date of acceptance of the work by the Owner or failure of system to meet performance requirements. Exhibit Fabricator shall agree to repair or replace defective materials and workmanship during the guarantee period at no additional cost to the Owner.

B. Defective materials and workmanship are hereby defined to include evidence of abnormal deterioration, aging, structural failure of components resulting from exposure to normal load and forces, failure of operating parts to function normally, sealant failures,

deterioration or discoloration of finishes in excess of normal aging, and failure to fulfill other specified performance.

PART 2 PRODUCTS

2.1 STONE

A. Stone slabs shall be: Slate with layered surface showing scaling , Limestone – similar to Mississipian Limestone , Alta Stock Granite – similar to Amarello Ornamental & Sandstone – desert bronze rippled

B. Finishes

1. Cleft (irregular)

C. Quarrying Supervision

1. Quarrying shall be coordinated with the quarrying for all Owner quarry stone as specified in the architectural specifications.

D. Examinations

1. Examination at the Quarry: Quarried blocks shall be made available for inspection by the Exhibit Designer and the Owner at his request.

2.2 ACCESSORY MATERIALS FOR STONEWORK

A. Stone Support

1. Manufacturer and General: Stone support systems, anchors and accessories shall be manufactured by a company specializing in the design and fabrication of stone approved by the Exhibit Designer. Provide all fastening devices, wire anchors, support angles, relieving angles, anchors, coping anchors, dowels, cramps, bolts, nuts, shims, expansion shields, flashing, etc., necessary to properly secure stone walls to the structure.

2. Steel:

a. Sheet, Bar and Plate: AISI Type 302/304 non-magnetic, conforming to ASTM A167.

b . Fasteners, Anchor Bolts, Nuts and Washers: AISI Type 302/304 non-magnetic, ASTM A167.

c. Shims: AISI type 302/304, non-magnetic.

2.3 FABRICATION

A. All stone shall be well-cured and seasoned before cutting. Cut stone units with bed, unless otherwise approved by the Exhibit Designer.

B. Stone shall be cut to sizes, shapes, profiles and dimensions approximating the shapes indicated in the design drawings.

C. Exposed surfaces and edges of stone units shall be free from cracks, broken corners, chipped arrises, scratches or other defects affecting appearance. Patching or filling not permitted.

D. Backs of stone units shall be sawn to true planes, parallel to face plane.

E. Cut stone units full and true on faces, reveals, beds, joint and top, to the full dimensions required by drawings. All edges shall be “irregular” according to the performance requirements for interactivity as stated above.

F. Make faces of stone units in same plane flush at joints. All finished surfaces shall be true in line and face.

G. Sawn surfaces and edges shall be cleaned of all rust stains and iron particles.

H. No patching or use of stone with chipped edges or faces shall be permitted.

I. Thickness: Provide stone panel of thickness shown on drawings. Saw-cut back surfaces which will be concealed in the finished work.

2.4 CUTTING, DRILLING AND FITTING

A. Provide holes and sinkages required for anchors, dowels, other devices required to support and/or suspend stone, and to accommodate other items which connect to or penetrate the stone.

PART 3 EXECUTION

3.1 INSTALLATION

A. Qualification of Workmen: All work shall be performed by skilled workmen, trained and experienced in this type of work.

B. Anchors: A minimum of 3 anchors shall be required on all pieces up to 3 square feet in area.

C. Set stone and install stone support systems in accordance with drawings and final shop drawings for stonework. Provide anchors, supports, fasteners, and other attachments shown, or necessary to secure stonework in place. Shim and adjust accessories as required for proper setting of stone. Completely fill holes, slots and other sinkages for anchors, dowels, fasteners, and supports during setting of stones.

D. Before setting in the wall, all stones shall be thoroughly cleaned on all exposed surfaces by washing with fiber brush and soap powder, followed by a thorough drenching with clear water.

END OF SECTION

SECTION 05500 - METAL FABRICATION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1. 2 WORK INCLUDED

A. Provide materials, labor, equipment and services necessary to furnish, deliver and install all work of this Section as shown on the drawings, as specified herein and/or as required by job conditions.

B. Work Included. This Section generally includes the following:

1. Metal framing, supports and armatures as described in the Exhibit Contract Documents, including but not limited to:

a. stone slab supports
b. exhibit casework framing
c. exhibit display walls

2. Structural design of the metal framing described in the Exhibit Contract Documents by Contractor's Professional Engineer, including Building Department filing requirements.

1.3 RELATED SECTIONS

Section 04400 - Stone Cladding
Section 12353 - Exhibit Casework
Section 16500 - Exhibit Lighting
Section 10600 - Partition Systems

1.4 SUBMITTALS

A. Product Data: Prior to fabrication submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.

B. Shop Drawings showing gauge, thickness, size and construction for each member and indicating the method of assembling components, with true profiles, connections to adjoining work, methods of anchoring, and anchorage templates.

1. As a part of the preparation of Shop Drawings, Contractor shall retain a Professional Engineer, license in the State of Utah, to review and design the metal framing described in the Exhibit Contract Documents. Contractor's Engineer shall supervise the design, review and sign and seal Shop Drawings, visit points of manufacture and construction, and submit structural calculations and drawings to the Building Department as required.

2. The metal structure supporting exhibit systems shall conform to the Building Code, which references the International Building Code 2006 edition. IBC 2006 requires compliance with reference standard ASCE 7-05 with respect to seismic criteria for architectural components.

3. Contractor's Engineer shall coordinate the support of metal framing with base building structure as required.

1.4 QUALITY ASSURANCES

A. Qualifications of Manufacturer: 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 Exhibit Designer.

B. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installations.

1.5 PRODUCT HANDLING

A. Protect materials from deterioration and damage by moisture, temperature change, contamination, corrosion and other causes.

PART 2 PRODUCTS

2.1 MATERIALS GENERAL

A. Where exposed to view, use only materials, which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

B. Metal: New and free from defects which might impair strength, durability or appearance to meet the following requirements:

1. Steel Plates, Structural Shapes and Bars: ASTM A36 A572, or A992.

2. Cold-Formed Steel Framing: ASTM C1007.

3. Steel Tubing: Cold formed, ASTM A 500; or hot-rolled, ASTM A501.

4. Structural Steel Sheet: Hot-rolled, ASTM A570; or cold-rolled ASTM A611, Class 1; of grade required for design loading. Gauges: U.S. Standard Gauge.

ii. Grout

1. Metallic Non-Shrink Grout: Pre-mixed, factory-packaged, ferrous aggregate grout.

2. Non-Shrink Non-Metallic Grout: Pre-mixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

iii. Fasteners

1. General: Provide zinc-coated fasteners where built into exterior walls. Select fasteners for the type, grade and class required.

2. Screws and bolts shall be U.S. Standard.

3. Bolts and Nuts: Regular hexagon head type, ASTM A307, Grade A.

4. Lag Bolts: Square head type.

5. Machine Screws: Cadmium plated steel.

6. Wood Screws: Flat head steel.

7. Plain Washers: Round steel.

8. Toggle Bolts: Tumble-wing type.

9. Lock Washers: Helical spring type carbon steel.

iv. Paint

1. Manufacturer's or fabricator's standard, fast-curing, lead-free, "universal" Primer, selected for to normal atmospheric corrosion, for compatibility with finish paint systems indicated.

2. Priming paint for ferrous metals shall be approved red lead rust inhibitive type complying with PPG Co., Red Lead Primer No. 6-203 or approved equal.

3. Galvanizing Repair Paint: High zinc dust content paint for galvanized steel.

v. Rough Hardware

1. Furnish fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required and shown on drawings for framing and supporting exhibitry.

2. Fabricate items of sizes, shapes and dimensions required. Furnish steel washers.

vi. Miscellaneous Framing and Supports.

1. Fabricate miscellaneous metal framing and supports to sizes, shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing.

2. Except as otherwise shown, fabricate from structural steel shapes and plates, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

3. Sleeves: Fabricate custom mounting sleeves, matching Designer's sample, of steel plate and rod for support of museum displays.

B. FABRICATION

i. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

ii. Perform cutting, fitting and drilling necessary so that work may be properly set in place to permit engaging work to be properly installed. File or grind smooth exposed edges.

iii. Furnish screws, bolts and other fastening devices needed for assembling and for attachment to engaging materials so as to avoid unnecessary cutting and drilling.

iv. At exposed connections use concealed fasteners wherever possible. Use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Include washers where necessary.

v. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

vi. Cut, reinforce, drill and tap miscellaneous metal work to receive finish hardware.

C. SHOP PRIMING FERROUS METAL:

i. Apply shop primer to surfaces of metal fabrications except those which are galvanized unless otherwise indicated, and in compliance with requirements of SSPC-PA1 "Paint Application Specifications No. 1" for shop painting.

ii. Surface Preparation: Prepare ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning".

PART 3 - EXECUTION

D. PREPARATION:

i. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

ii. Coordinate work of this Section with related work of other sections.

iii. Furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

E. INSTALLATION

i. General: Metal work shall be well formed to designated shapes and sizes with sharp lines and angles. Shearing and punching shall leave clean, true lines and surfaces.

ii. Rebates, lugs and brackets shall be provided to permit assembly in a neat, substantial manner. Fastenings shall be concealed where possible. There shall be no wind in the built-up parts. Joints exposed to the weather shall be formed to exclude water

iii. Steel: Permanent connections for steel work shall be riveted where practicable. Rivet and bolt heads shall be countersunk flush with surface.

F. CUTTING, DRILLING AND FITTING:

i. Perform cutting, fitting and drilling necessary so that work may be properly set in place to permit engaging work to be properly installed.

ii. Furnish screws, bolts and other fastening devices needed for assembling and for attachment to engaging materials so as to avoid unnecessary cutting and drilling. Proper washers shall be included as necessary.

iii. Sharp exposed edges shall be filed or ground smooth and round and free from burrs.

G. WELDING:

i. Welding shall be done in accordance with the requirements of the American Welding Institute.

ii. Welding shall be either oxyacetylene or electric arc process

iii. Use only certified/licensed welders.

iv. Wherever possible, welding operations and the tensioning of high strength bolt connections shall be done in shop. If such connections must be done in field, the calculated stresses in the welds or bolts shall be less than 50% of basic allowable values.

v. If required, be responsible for providing a statement by a licensed engineer certifying that this condition exists. Pay expenses incurred by this or by the authorities' requirement for controlled inspections, at no extra cost to Owner. Provide proof of welders' certification on demand.

vi. Exposed joints shall be finished smooth, flush and be practically invisible.

H. PROTECTION:

i. Protect all protruding pieces for damage during construction.

I. ADJUST AND CLEAN

i. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

ii. For Galvanized Surfaces: Clean field welds, bolted connections and abraded areas and apply zinc-rich galvanizing repair paint to comply with ASTM A780.

END OF SECTION

SECTION 06100 - ROUGH CARPENTRY

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1. 2 WORK INCLUDED

A. Provide materials, labor, equipment and services necessary to furnish, deliver and install all work of this Section as shown on the drawings, as specified herein and/or as required by job conditions.

B. Work Included: This Section generally includes the following:

1. Miscellaneous wood framing, backing and supports

1.3 RELATED SECTIONS

Section 05500 - Metal Fabrications
Section 06430 - Exhibit Woodwork

1.4 REFERENCE STANDARDS

A. Lumber Standards: Comply with PS 20 and with applicable rules of the respective grading and inspecting agencies for species and products used.

B. Plywood Product Standards: Comply with PS 1 (ANSI A 199.1) or, for products not manufactured under PS 1 provisions, with applicable APA Performance Standard for type of panel specified.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for manufactured materials.

B. Wood Treatment Data: Where required by code, treat wood products for permanent installation under this section with fire retardant in accordance with AWPA standards.

1. Include certification by treating plant stating type of preservative and process used, net amount of preservative retained and conformance with applicable standards.
2. Include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.

1.6 QUALITY ASSURANCE

A. Inspection Agencies: Inspection agencies and abbreviations used for reference of lumber grade and species include the following:

1. Southern Pine Inspection Bureau (SPIB)
2. West Coast Lumber Inspection Bureau (WCLIB)

3. Western Wood Products Association (WWPA)

B. Grade Stamps: Use lumber factory-marked with grade stamp of inspection agency to show compliance with grading rule requirements. Stamp must identify grading agency, grade, species, moisture content at time of surfacing and mill.

1.7 PRODUCT HANDLING

A. Keep materials under cover and dry. Protect against exposure to weather and contact with moist surfaces. Stack lumber and plywood; provide for air circulation within and around stacks.

1.8 COORDINATION

A. Fit rough carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports for attachment of other work.

PART 2 - PRODUCTS

2. 1 LUMBER – GENERAL

A. Lumber Standards: Mill lumber to comply with PS 20 "American Softwood Lumber Standard" and applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

1. Lumber for framing, bridging, blocking, grounds, furring, nailers, etc. shall be construction grade or better.

B. Nominal sizes are indicated, except as shown by detail dimensions. Provide sizes and moisture contents as required by PS 20.

1. Provide dressed lumber, S4S, unless otherwise indicted.
2. Moisture Content: 19 % maximum at time of shipment for sizes 2" or less in nominal thickness.

2. 2 MISCELLANEOUS LUMBER

A. General: Provide wood for support or attachment of other work including bucks, nailers, blocking, furring, grounds and similar members. Provide lumber of sizes indicated and as follows:

1. Moisture Content: 19 % maximum.

2. Grade: Standard Grade light framing size lumber of any species or board size lumber as required. No. 3 Common or Standard grade boards per WCLIB or WWPA rules or No. 3 per SPIB rules.

2. 3 FASTENERS AND ANCHORAGES

A. Provide fasteners of type, size, material and finish as required for condition of use.

B. Where rough carpentry work is exposed to moisture, provide fasteners and anchorages with cadmium plating or a hot-dip zinc coating (ASTM A 153).

2. 4 WOOD TREATMENT BY PRESSURE PROCESS

A. Preservative Treatment: Comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood) and of AWPB Standards listed below. Mark each treated item with the AWPB Quality Mark.

1. Where required by code, pressure-treat lumber and plywood with fire-retardant chemicals, "Dricon" by Hickson Corporation or approved equal, applied in accordance with manufacturer's directions.

2. Pressure-treat wood members in contact with masonry or concrete with water-borne preservatives to comply with AWPB LP-2. After treatment, kiln-dry lumber and plywood to a maximum moisture content of 15 %.

3. Complete fabrication of treated items prior to treatment where possible. If cut after treatment, coat cut surfaces with heavy brush coat of chemical used for treatment to comply with AWPA M4.

PART 3 - EXECUTION

3. 1 INSTALLATION – GENERAL

A. Discard units of material with defects that might impair quality of work and units which are too small to use.

B. Set carpentry work to required levels and lines with members plumb and true and cut and fitted.

C. Securely attach carpentry work to substrate by anchoring and fastening as required by recognized standards.

D. Countersink nail heads on exposed carpentry work and fill holes.

E. Select fasteners of size that will not penetrate from opposite side of members that will be exposed. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.

3. 2 FRAMING INSTALLATION

A. Provide framing members of sizes and install at spacings shown; comply with National Forest Products Association recommendations. Do not splice structural members between supports.

B. Provide necessary furring, accessories, framing and blocking at walls and ceilings as shown on drawings or as required.

3. 3 NAILERS, BLOCKING AND GROUNDS

A. Provide where required for attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

B. Attach to substrates to support applied loading. Countersink bolts and nuts flush with surfaces when necessary.

END OF SECTION

SECTION 06403 - EXHIBIT WOODWORK

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 WORK INCLUDED

1. LAND gallery MDF wall panels (X-MDF-1)
2. LIFE Ecosystem wall panels with Laminated Wood Veneer (X-WD-3)
3. Exhibit tables/ elements with Laminated Wood Veneer (X-WD-1)
4. Exhibit plinths with paint finish
5. Misc. Exhibit Woodwork

1.3 RELATED SECTIONS

Section 06100 - Rough Carpentry
Section 09920 - Painting
Section 10000 - Silkscreened Graphics
Section 12353 – Exhibit Casework

1.4 DEFINITIONS

A. Exhibit Woodwork includes wood panels, furring, blocking, shims,j and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

1.5 SUBMITTALS

A. General: Submit in accordance with Section 01330 – Submittal Proceedures.

B. Product Data: For each type of product indicated, including fasteners, hardware and accessories, and finishing materials and processes.

1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Exhibit Fabricator's verification of all dimensions coordinated with survey drawings of as built conditions.

2. Show details full size.

3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

4. Show locations and sizes of cutouts and holes for items installed using dimensions taken from measurement of actual hardware.

5. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

D. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.

1. Shop-applied transparent finishes and tinted lacquered.

2. Shop-applied opaque paint finishes.

E. Samples for Verification:

1. (3) 8” x 8” MDF panels with shop-applied tinted clear lacquer finish including edges for panels.

2. (3) 8” x 8” Quarter sawn maple veneered MDF panel, with veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork. Include veneer at edges and at least one face-veneer seam.

3. (3) 8” x 8” COR product veneered, with veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork. Include veneer at edges and at least one face-veneer seam.

4. (3) 8” x 8” MDF panels with shop-applied opaque painted finish including edges for panels, for each color specified.

5. Corner pieces as follows:

a. Miter joints for MDF exhibit plinths.

6. Exposed hardware and accessories, one unit for each type and finish.

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

G. Material Safety Data Sheets, for all applicable products.

1.6 QUALITY ASSURANCES

A. Installer Qualifications: An experienced installer who has completed exhibit woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Fabricator Qualifications: A firm experienced in producing exhibit woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of exhibit woodwork.

D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior woodwork, construction, finishes, and other requirements.

1. Provide AWI Quality Certification Program certificate indicating that woodwork complies with requirements of grades specified or proof that the Exhibit Fabricator meets or exceed the AWI requirements.

E. Mockup: Before fabricating exhibit woodwork, build mockups for each form of construction and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Build a full size LAND panel minimum size 4' x 8' to demonstrate the following;

a) coordination with adjacent elements (stone panels and inset casework)
b) mount system
c) edge detailing at reveals
d) reveals between adjoining panels
e) proposed range of aesthetic effects and workmanship

2. Build a full size LIFE panel minimum size 4' x 8' to demonstrate the following;

a) edge detailing at reveals and openings into dioramas
b) reveals between adjoining panels
c) proposed range of aesthetic effects and workmanship

3. Notify Exhibit Designer one month in advance of dates and times when mockups will be fabricated and installed.

4. Obtain Exhibit Designer's approval of mockups before commencing with exhibit woodwork fabrication.

1.7 PRODUCT HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions can be and are maintained to the level that will prevent defects from forming in the finished work.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

2. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

3. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior Exhibit Designer woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products:

1. Medium-Density Fiberboard- Formaldehyde Free to comply with ANSI A208.2 - (X-MDF-1)
2. Quarter sawn Maple Hardwood Veneer to comply with HPVA HP-1 - (X-WD-3)
3. COR product Engineered Wood Veneer - (X-WD-1)
4. Softwood Plywood to comply with DOC PS 1, Medium Density Overlay

2.2 HARDWARE AND ACCESSORIES

C. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Steel with custom black tinted, clear lacquer as per Section 05500 –Metal fabrications

E. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.3 INSTALLATION MATERIALS

F. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

G. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

H. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls

and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 PART - EXECUTION

A. PREPARATION:

1. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

2. Before installing exhibit woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

B. INSTALLATION:

1. Quality Standard: Install woodwork to comply with AWI Section 1700.

2. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

3. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

4. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with recommendations of chemical treatment manufacturer, including those for adhesives used to install woodwork.

5. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

6. Complete the finishing work specified in this Section to extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in shop.

7. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

8. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

9. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

10. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

11. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

12. Notify Exhibit Designer seven days in advance of the dates and times woodwork fabrication will be complete.

13. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates measured form actual hardware to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

C. ADJUSTING AND CLEANING

1. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

2. Clean, lubricate, and adjust hardware.

3. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 09771 – FABRIC WRAPPED PANELS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 WORK INCLUDED

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the fabric wrapped panels as shown on the drawings and/or specified herein, including, but not limited to, the following:

1 Fabric-wrapped artifact case decks, buildups, back panels, etc., within Exhibit Cases.
2 Stretched Fabric panels in OUR BACKYARD

1.3 RELATED SECTIONS

1.4 Section 05500 - Metal Fabrications
1.5 Section 12353 - Exhibit Casework

1.6 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product data for each type of fabric and installation accessories required. Submit written data on physical characteristics, durability, resistance to fading, flame resistance characteristics, and certification of environmentally safe standards.

C. Samples:

1 (3) twelve-inch (12”) square samples for each fabric and color specified.
2 (3) fabric-wrapped twelve-inch (12") square samples of each type of substrate specified.
3 Adhesive Compatibility

D. Maintenance Data:

1 Provide the Exhibit Designer with a manual which shall describe the care, cleaning and maintenance of the installed fabrics.

1.7 TESTING

A. All Products specified under this Section and used inside Exhibit Cases will have to be submitted for testing and need to be approved by the Owner’s Conservator.

1.8 QUALITY ASSURANCES

A. Qualifications of Manufacturer: 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 Exhibit Designer.

1.9 DELIVERY, STORAGE AND PRODUCT HANDLING

A. Protect materials from deterioration and damage by moisture, temperature change, contamination, and other causes.

B. Deliver the panels, and accessory items to the areas of the building where installation is scheduled. Coordinate for the proper scheduling of this work. Store materials in areas designated, and carefully protect panels from damage.

PART 2 PRODUCTS

2.1 MATERIALS:

A. Fabric: Cotton/ Silk blend, 54 inch minimum wide roll, solid color, weight approx. 8oz/ yard. Color to be determined by Exhibit Designer. Fabric to be approved by the Client's Conservator.

1 Acceptable Products:

a. Creation Baumann –
b. Donghia Textiles – Antoinette Satin Series (75% cotton/ 25% silk)
c. Bergamo – Leonardo Series (68% cotton/ 32% silk)
d. Approved Equal in accordance with Section 01600.

B. Fabric Adhesive: As per Fabric Manufacturer recommendation. Adhesive to be approved by the Client's Conservator.

C. Panel Substrate: Built-up Metal Panel. Substrate to be approved by the Client's Conservator.

2.2 FABRICATION:

A. Panel Fabrication Workmanship:

1 Fabric shall be applied in a consistent direction within each Case, and from Case to Case in adjacent exhibits.

2 Fabric shall show no evidence of adhesive bleed-through.

3 Weave of fabric shall remain even and straight across the face of wrapped surfaces, and shall not be stretched, pulled, or distorted.

4 Contractor shall inspect fabrics before incorporating them into the Work. Any piece of fabric which shows any discoloration, pulled threads, or other blemishes which would be visible in the finished Work shall not be used.

5 Panel shall be covered with a single piece of fabric. If fabric needs the be seemed provide drawing indicating seem location prior to fabrication. The fabric shall wrap over all the edges of build-up panel with a minimum of a 3/4 inch margin.

PART 3 EXECUTION

3.1 EXAMINATION

A. Study the Contract drawings and specifications with regard to the work as shown and required under this section so as to insure its completeness.

B. Examine surfaces and conditions to which this work is to be attached or applied, and notify the Exhibit Designer of any conditions or surfaces which are detrimental to the proper and expeditious installation of the work. Starting on the work, shall imply, acceptance of the surfaces and conditions to perform the work as specified.

C. Verify dimensions taken at the job site, affecting the work. Bring field dimensions which are at variance to the attention of the Designer. Obtain decision regarding corrective measures before the start of installation.

D. Cooperate in the coordination and scheduling of the work of this section with the work of other sections so as not to delay job progress.

3.2 INSTALLATION

1 Fabric-covered surfaces shall be handled carefully and maintained absolutely clean and free of dust until final acceptance. Fabric-covered surfaces shall be covered with a protective wrapping until installed in Exhibit Cases. Contractor's installers shall wear disposable white cotton gloves when handling fabric-covered surfaces during installation in Exhibit Cases.

3.3 CLEAN-UP & PROTECTION

A. Upon completion of the work, remove all waste, excess materials, tools and equipment from the job site.

B. Prior to acceptance of the installation, panels which are damaged, stained, discolored, torn, ripped or otherwise not acceptable, shall be repaired and/or replaced with new material of same dye-batch.

C. Protect installed panels from damages by other trades. Install and maintain protective materials over panels if necessary.

D. After the installation is completed provide representatives to instruct the Clients maintenance personnel in the care, cleaning and maintenance of the installed panels.

PART 4 END OF SECTION

SECTION 09920 - PAINTING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 WORK INCLUDED

A. The Work shall include, but is not limited to the following:

1. Prime and finish painting, including touching up of and repairing of abraded, damaged or rusted prime coats.
2. Painting of MDF, wood and metal as indicated on the drawings.
3. Painting of any surface not specifically mentioned to be painted herein or on drawings but for which painting is obviously necessary to complete the work.

B. Related Work Specified Elsewhere;

Section 05500 - Metal Fabrications
Section 05700 - Ornamental Metal
Section 06430 - Exhibit Woodwork
Section 10000 - Silkscreened Graphics

1.3 MATERIALS AND EQUIPMENT NOT TO BE PAINTED

A. Surfaces not to be painted shall be left completely free of droppings and accidentally applied materials. Unless otherwise indicated, the following shall not be painted:

1. Non-ferrous metals
2. Concealed surfaces not exposed to view
3. Items furnished with factory finish
4. Moving mechanical equipment parts
5. Code-required labels

1.4 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Materials List: Prior to delivery, submit to the Exhibit Designer a complete list of all materials and applications. This shall in no way be construed as permitting substitution of materials for those specified or accepted for this Work by the Exhibit Designer.

1. Include certificates attesting to compliance with Specifications, verifying compatibility of finish and intermediate coats with prime coats applied under this or other Sections and verifying compatibility of coatings with the substrates to which they will be applied.

C. Samples and Product Literature: Prior to beginning Work, submit samples for review of color, sheen and texture. Provide a listing of materials and application for each coat of each finish sample. Submit three (3) of each of the following to the Exhibit Designer for review.
   1. Color system of the paint manufacturer from which the Exhibit Designer will select the paint colors;
   2. Provide (3) 12" x 12" x 3/4" MDF panels with finished edges for each color of paint and finish by type with finish applied;
   3. Provide (3) 12" x 12" x 1/4" steel panels, 6" length of bar stock with fasteners with finish applied;
   4. Provide (3) 12" x 12" Quarter sawn Maple wood veneer on 3/4" MDF panel with finish applied;

D. Furnish the Exhibit Designer with a schedule indicating completion of the respective coats of paint for the various areas and surfaces.

1.5 QUALITY ASSURANCES

A. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces.

B. Source Limitations: Obtain Block Fillers and primers for each coating system from the same manufacturer as the finish coats.

C. LEED Compliance: All paint and coating products must be low VOC content paints.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Order materials sufficiently in advance and in adequate quantities to avoid delays of the Project. Paints shall be ready-mixed, unless otherwise directed by the Exhibit Designer.

B. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label with the following information:

   1. Name or title of material
   2. Product Description
   3. Manufacturer's stock number and date of manufacture
   4. Manufacturer's name
   5. Contents by volume for major pigment and vehicle constituents
   6. Thinning instructions
   7. Application instructions
   8. Color name and number
   9. VOC content

C. Storage and Protection.

   1. Store only approved materials at the job site in an area used solely for the storage of paint materials and related equipment. Use a dry, well-ventilated space with a temperature range between 60 and 80 degrees F. Store materials not in use in tightly covered containers maintained in clean condition and free of foreign material and residue.
   2. Protect paint materials before, during and after application, and ensure the prompt and safe disposal of related waste products.
   3. Protect finished work and materials of other trades, and in the event of damage, immediately make all repairs and replacements.

1.7 PROJECT CONDITIONS

A. Examine areas to receive painting, and notify Exhibit Designer of any conditions observed that would be detrimental to the quality of completed work.

B. Apply paints only to surfaces that are clean, dry and free from frost in an atmosphere that is free from dust and airborne material that might become embedded on freshly painted surfaces.

C. Do not apply paint when relative humidity exceeds 85% unless specifically permitted by the manufacturer and approved by the Designer.

D. Commence painting only after lighting fixtures have been installed and are in use, or after temporary lighting providing 50 average foot candles has been provided.

E. Equipment: Provide scaffolding, ladders and other equipment necessary for the proper execution of the work of this section, all conforming to applicable laws, rules and regulations.

F. Protection: Provide and maintain warning signs and coverings and other protection to prevent damage to work of this section and to the work of others.

PART 2 - PRODUCTS

2.1 MATERIALS – GENERAL

A. Paint shall arrive to the job site in factory labeled unopened containers, color-mixed except for tinting of undercoats and possible thinning.

B. Provide prime paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only to recommend limits

C. Paint colors, surface treatment and sheens are indicated on the Contract Drawings. Certain colors may require paint manufacturer to prepare special factory mixes to match colors selected by the Designer.

D. Paint surfaces as specified. However, the Exhibit Designer reserves the right to change finishes within the range of flat, eggshell, semi-gloss or gloss, without additional cost to the Owner.

E. Mixed colors shall match the color selection made by the Exhibit Designer prior to application of the coating.

F. For alkyd paints, provide certification from manufacturer that selected colors will be available for at least 5 years from time of application. Certification shall state that the colors will not differ due to changes in their chemical composition, particularly resultant from quantities and types of solvents used.

G. Unless otherwise noted, specified products are manufactured by Benjamin Moore & Co. Provide products specified or equivalent products manufactured by the following:

1. PPG Industries
2. Sherwin Williams
3. Or approved equal.

H. Pigments: Pure, non-fading and of types to suit paints, substrates and service indicated.

I. Linseed Oil: Raw or boiled, as required, and of approved manufacture as per ASTM D234 and D260, respectively.

J. Turpentine: Pure distilled gum spirits of turpentine, per ASTM D13.

K. Driers, Putty, Spackling Compound, Patching Plaster, etc.: Best quality, of approved manufacturer.

L. Heat Resistant Paint: Where required, use heat resistant paint when applying paint to heating lines and equipment.

M. Galvanizing Cleaner: Porter Prep. No. 99, applied per manufacturer's instructions.

N. Galvanizing Primer: Porter No. 299 Alkyd Zinc Dust Primer applied per manufacturer's instructions.

2.2 PAINT SYSTEMS

A. Exhibit Plinths and Panels as specified
   1. MDF – Flat Latex finish by Benjamin Moore & Co. (Spray Application in Shop with touch up on-site). Apply according to manufacturer's recommendations.

      a. Prime Coat: Benjamin Moore
      b. Second - Fourth Coats: Benjamin Moore: Moorecraft Super Spec Latex Flat No. 275
      c. Color: to be specified by Exhibit Designer
      d. sand between coats.

B. Maple Veneer

   1. Maple Veneer - Waterborne Clear Satin Varnish by Benjamin Moore & Co. (Spray Application in Shop). Apply according to manufacturer's recommendations.

      a. Prime Coat: Benjamin Moore & Co.'s interior Wood Finishes Quick-Dry Sanding Sealer No. 413.
      b. Second - Third Coats, Benjamin Moore's Stays Clear Acrylic Polyurethane No. 423. Satin.
      c. Color: clear.
      d. Apply at spreading rate recommended by manufacturer.

C. Exposed Ferrous Metal

   1. Ornamental Metals – Blackened Steel Presto Black Gel by Birchwood Casey (800) 328-6156. (Application in Shop). Apply according to manufacturer's recommendations.

      a. Finish Coat: Presto Black Gel (brush applied)
      b. Sealant:, Birchwood Casey's Dry Touch Plus IRP3 Satin.
      c. Color: blackened/ tinted steel to match Exhibit Designer's sample.

D. Concealed Ferrous Metal

1. Flat Alkyd Finish

    a. Prime Coat: Iron Clad Retardo Rust Inhibitive Primer (163)
    b. Second and Third Coats: Alkyd Dulamel (207)
    c. Color: as specified by Exhibit Designer.

PART 3 PART - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where the painting is to be performed and notify the Designer of conditions detrimental to the completion of the work.

B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean surfaces to be painted before applying paint or treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning.

B. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Mix and prepare painting materials in strict accordance with the manufacturer's directions to produce a mixture of uniform density. Remove film, and strain if necessary.

D. Protect adjacent work and materials by covering, masking or other method.

E. Remove and protect hardware, accessories, plates, lighting fixtures, factory finished work and similar items, or provide in-place protection. Upon completion of each space, carefully replace all removed items.

F. Remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.

G. Metal Surfaces: Fill dents, cracks, hollow places, open joints and other irregularities in metal work to be painted with approved metal filler and sand to a smooth, hard finish, flush with adjoining surface.

    1. Weld Fluxes: Remove weld fluxes, splatters and alkali contaminants from metal surfaces in an approved manner and leave surface ready to receive painting.
    2. Bare Metal: Thoroughly clean off all foreign matter such as grease, rust, scale and dirt before priming coat is applied. Clean surfaces by flushing with mineral spirits.
    3. Shop Primed Metal: Clean off foreign matter as specified for "Bare Metal". Prime bare, rusted, abraded and marred surfaces with approved primer after proper cleaning of surfaces. Sandpaper all rough surfaces smooth.
    4. Galvanized Metal: Wipe down surface as per SSPC Spec. SP-1. Clean with galvanize cleaner, then wash with clear water.

H. Gypsum Board Surfaces: Scrape off all projections and splatters, spackle all holes or depressions, including taped and spackled joints and sand smooth.

I. Wood Surfaces: Clean, sand and touch-up prime coat. Conform to standards of approved Job Mock-Up.

J. Cementitious Surfaces: Roughen to remove glaze if necessary, and remove efflorescence, chalk, dust and oils.

1. Test for the presence of alkali. If present, treat and allow surface to dry 24 hours before applying paint. Re-coat “hot spots,” appearing after applying primer until all suction is sealed. Surfaces which are to receive Latex Primer need no treatment.
2. Test for moisture content using an electronic moisture meter. Do not apply paint or sealer to any surface or to latex type filler where the moisture content exceeds 8% as measured by the moisture meter.

3.3 APPLICATION

A. Application may be by brush or roller or by electrostatic spray where scheduled.

B. Apply paint by brush or roller in accordance with the manufacturer’s directions. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back or high pile sheep's wool as recommended by the paint manufacturer for material and texture required.

C. All materials shall be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.

D. Coverage and hide shall be complete. When color, stain, dirt or undercoats show through final coat of paint, the surface shall be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage at no additional cost to the Exhibit Designer.

E. Tint each undercoat a lighter shade where multiple coats are applied. All coats shall be dry to manufacturer’s recommendations before applying succeeding coats.

F. All suction spots or “hot spots” after the application of the first coat shall be touched up before applying subsequent coats.

G. Take care to ensure that all surfaces, including edges, corners, crevices, welds and exposed fasteners, receive a film thickness equivalent to that of flat surfaces.

H. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind (out of the sight line) permanently fixed equipment or furniture with prime coat only.

I. Match colors and textures to approved samples and mockups, and remove finish and repaint surfaces that do not comply.

J. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint before final installation of equipment.

K. “Touching-Up” of Factory Finishes: Unless otherwise indicated, materials with a factory finish shall not be painted at the project site. To “touch-up,” use the factory finished material manufacturer’s recommended paint materials to repair abraded, chipped or otherwise defective surfaces.

L. Paint Thickness: Follow the specified minimum dry film (MDF) thickness requirements in the application of two-coat and three-coat work; the MDF for each coat shall not be less than 1.5 mils., or as recommended in paint manufacturer's printed specifications:

1. Three-coat work shall not be less than 5.0 mils total.

2. Two-coat work shall not be less than 3.0 mils total.

3.4 CLEAN UP

A. During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.

B. Upon completion of painting work, clean glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or damage finished surfaces.

C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.5 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by the painting and finishing work. Leave all such work undamaged. Correct any damages by cleaning, repairing or replacing and repainting, as acceptable to the Exhibit Designer.

B. Provide “Wet Paint” signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

END OF SECTION

SECTION 10000 – SILK-SCREENED GRAPHICS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 WORK INCLUDED

A. The Work in this Section shall include, but is not limited to, all labor, materials, equipment, etc. necessary to prepare and screen all the silk screened text and art as shown in drawings and specified herein.

1.3 RELATED SECTIONS

Section 05500 - Metal Fabrications
Section 06430 - Exhibit Woodwork
Section 09912 - Painting

1.4 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: Prior to fabrication submit manufacturer's specifications and installation instructions for products used in silk-screening process, including paint products.

C. Shop Drawings: Submit shop drawings for approval for all exhibit components that are to receive silk-screened text and or artwork, indicating size, material, and integration of panels into exhibits.

D. Samples:

1 The contractor shall submit samples, to verify quality standards to be met. Ex: small text or thin line clarity, color registration, image quality

2 Silk screen artwork for use in fabrication of the samples shall be provided by the Exhibit Designer.

3 The Exhibit Fabricator shall submit samples of each application, based on graphic production files provided by the Exhibit Designer to verify quality standards to be met. Submittals will include Three (3) 12” x 12” panels with silkscreened art for:
   a. each color specified
   b. multiple colors
   c. each type of finished substrate (e.g. glass, wood, metal)

1.5 QUALITY ASSURANCES

A. Contractor qualifications shall be a firm who can submit supporting documentation of having been continuously in the business of installing producing silk-screened graphics of the type and kind specified herein for no less than five (5) years.

1.6 PRODUCT HANDLING

A. Protect materials from deterioration and damage by moisture, temperature change, handling, and other causes.

1.7 DELIVERY, STORAGE AND PRODUCT HANDLING

A. Contractor shall protect Silk-Screened Panels against dampness during and after delivery and while installation is underway.

B. Contractor shall protect Silk-Screened Panels from surface damage, scratches and abrasion during installation of Exhibits. Contractor shall replace all damaged Silk-Screened Panels that cannot be touched up to the satisfaction of the Architect. Contractor shall replace or retouch damaged work prior to final acceptance by the Architect at no additional cost to the Architect.

PART 2- PRODUCTS

2.1 MATERIALS GENERAL

A. INK: Oil base, semi-gloss, epoxy enamel or such high quality ink to be compatible with the surface receiving the screen.

B. SCREEN: Synthetic fabric with weave fineness equal to a 120-220 silk mesh, or as required by nature of artwork.

C. PANELS: As indicated on Drawings and on the graphic panel schedule.

D. PAINT: Spray lacquer, satin finish all sides and edges.

2.2 PRODUCTION

A. METHOD: All artwork on screens to be photographically reproduced employing the "indirect" method of stencil preparation, unless otherwise approved by the designer.

B. WORKMANSHIP:

1 Ink application to be continuously even and opaque.

2 Edges of art and type to be razor-sharp with absolutely no evidence of bleeding.

3 There are to be no mesh marks or saw-toothing.

4 Accurate registration required.

5 All minor imperfections are to be touched-up or cleaned-up, leaving the finished work perfect in every respect.

6 All production screen mesh shall be appropriately stretched around rigid frames as per U.S industry standards.

C. ORIGINAL ART:

1 The Exhibit Designer will furnish all camera-ready art work for preparation and silk screening.

2 Mechanical art shall typically be furnished as digital files at full size or percentage thereof. Contractor to prepare film positives at full size suitable for stencil preparation. All silk screened art to be output directly from full-scale digital files to1200 dpi Linotronic film or equal. In some cases, over-sized graphics may be output to film negatives at 2400 dpi for enlargement. Art may not be enlarged more than 400% to achieve full size.

3 Instruction boards and/or elevations provided by Exhibit Designer will include production notes, dimensions and reference codes used in drawings and schedules.

4 When the camera-ready art is produced, contractor shall notify designer if there are any problems or discrepancies between the graphic elevations for production and the camera-ready art.

D. SILKSCREENING:

1 Silk-Screening shall be performed on surfaces indicated in the Drawings and the Graphic Panel Schedule.

2 Contractor shall allow silkscreen enamels to dry at least 48 hours prior to installation of finished surfaces in exhibit.

3 All positive or negative films for silk screening shall be of proper size and quality.

2.3 COORDINATION / NOTIFICATION

A. Due to the close dimensional tolerances required to successfully execute the work, Contractor shall closely coordinate Silk-Screened Panel sizes, locations, and mounting hardware with all adjoining work. If any dimensional discrepancies are found, contractor shall notify designer before proceeding with the work affected.

B. Contractor to notify Exhibit Designer if hardware conflicts with Silk-Screened Graphics.

C. Contractor shall notify Exhibit Designer if original material is scratched or otherwise damaged in any way which would appear in the produced panel, before proceeding with production of that panel.

2.4 INSPECTION

A. Contractor to inspect all panels prior to installation. Panels to be inspected against signed-off galleys to insure the proper use of fonts, that all graphic elements are present; that color applications are correct; and that all spot-colors match approved control samples.

B. Exhibit Designer retains the right to reject any panels after installation that do not meet the requirements above.

C. Contractor shall afford the Architect and or Exhibit Designer access to facilities for inspecting the graphic work before, during, and after the production stage throughout the course of fabrication. Contractor shall give five days notice to the Architect and or Exhibit Designer before work is ready for inspection.

D. Contractor to alert Exhibit Designer of any conflicts between panel hardware and applied graphics prior to fabrication.

E. Contractor shall remove and replace any work found defective after installation at no additional cost to the Architect.

2.5 OWNERSHIP OF GRAPHICS

A. All graphics-related products required shall become the property of the Architect upon completion of the project and shall be transmitted to the Architect at no additional cost. This includes, but is not limited to:

1 Artwork

2 Positive and Negative Films

3 Photographic Products

4 Contractors Digital Production Files

PART 3 PART - EXECUTION

3.1 PREPARATION:

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Coordinate work of this Section with related work of other sections.

3.2 PROTECTION:

A. During shipping and on-site storage, the contractor shall ensure that all Silk-Screened Art will be adequately protected with bubble-wrap and cardboard corner protectors (for individual panels) up to the point of installation. The contractor shall also ensure that all Silk-Screened Art will be handled in such a way that they will be perfect and unmarred when installation is complete.

3.3 INSTALLATION

A. Contractor shall remove and replace any work found defective after installation at no additional cost to the Architect.

B. Silk-Screened Panels shall be handled carefully and maintained absolutely clean and free of dust until final acceptance. Silk-Screened Panels shall be covered with a protective wrapping until installed in Exhibits. Contractor's installers shall wear disposable white cotton gloves when handling Silk-Screened Panels during installation in Exhibits.

3.4 CLEANING

A. Upon completion of the work and when all danger of damage to graphics and photographs is past, Contractor shall inspect and clean all work contained in this section to the satisfaction of the Architect and the Exhibit Designer.

END OF SECTION

SECTION 10200—DIGITAL OUTPUT PANELS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 WORK INCLUDED

A. The Exhibit Fabricator shall furnish all labor, materials, equipment, etc., necessary to produce and install all Digital Output panels as detailed in the Drawings and Schedules, and as specified in this document.
   1 Laminated Graphics (lg)
   2 Inkjet (ij)
   3 Direct to substrate (ds)

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's, fabricator's and finisher's specifications and installation instructions for each product.

B. Shop Drawings: Prior to fabrication and/or purchase prepare shop drawings of work and submit to and obtain Exhibit Designer's approval thereof. Shop drawings shall be based on drawings, specifications and field measurements essential for proper fitting of Photomurals with other construction or existing architecture, and shall present complete information as to illustrate for the Exhibit Fabricator the general character of the Photomurals. Actual artwork to produce Digital Photo Print panels will be provided by the Exhibit Designer as digital files

C. Samples:

   1 The Exhibit Fabricator shall submit samples of each application, based on graphic production files provided by the Exhibit Designer to verify quality standards to be met. Quantity of samples must be submitted according to the requirements set forth in Section 01330 – Submittals.

   2 Exhibit Fabricator shall submit for approval completed samples of each photographic print listed below. These shall be submitted as complete assemblies, panel w/ protective UV film as specified in this section.
      a. Color photograph with dropped-in caption on contrasting background.

   3 In addition, Exhibit Fabricator shall submit to the Exhibit Designer test strips at full scale for panels over 4 feet in the shortest dimension, and for any area for which image resolution may not be adequate, or the acceptability of the outcome otherwise uncertain. Area to be tested shall be selected by Exhibit Designer. Exhibit Designer shall provide photo originals.

1.4 PRODUCT HANDLING

A. Exhibit Fabricator shall protect Digital Output panels against dampness during and after delivery and while installation is underway.

B. Exhibit Fabricator shall protect Digital Output panels from surface damage, scratches and abrasion during installation of exhibits. Exhibit Fabricator shall replace all damaged Digital Output panels that cannot be touched up to the satisfaction of the Exhibit Designer. Exhibit Fabricator shall replace damaged work prior to final acceptance by the Exhibit Designer at no additional cost to the Exhibit Designer.

PART 2 - PRODUCTS

2.1 PANEL TYPES:

A. Laminated Graphics – to be IZone or eq. Digital High Pressure Phenolic Laminate
B. Inkjet -
C. Direct to substrate -

2.2 FILMS:

A. PROTECTIVE FILM: Seal Print Shield, satin finish, as manufactured by Seal Products Incorporated, Naugatuck, CT 06770

B. ADHESIVE FILM: "Optimount", as manufactured by Seal Products Incorporated, Naugatuck, CT 06770

2.3 ORIGINAL PHOTOGRAPHY AND ART

A. The position and size of each photo panel will be specified in the Drawings and Schedules to be provided by the Exhibit Designer. Image crops will be specified on the cropping guides provided by the Exhibit Designer.

B. The Exhibit Designer shall supply all original material in the form of a high resolution scan, color or black and white transparencies and/or negatives and original artwork. Final high resolution scans of the original material submitted for output shall be provided by the Exhibit Fabricator. Each of the files or the items to scan will be marked with a reference number, as well as reference numbers of the loaning photographer or institution. In all cases, these numbers must be used as reference for production and should remain intact. All acetate sleeves, covers, envelopes, etc. associated with each original must be kept with it and returned to the Exhibit Designer. Specific cropping information will be provided with each original and shall be returned with the original to the Exhibit Designer.

2.4 PRODUCTION

A. METHOD:

1 Digital files as provided by the Exhibit Designer must not be altered without notification.

2 Digital files that require rasterization in PhotoShop for must be rasterized at 400 dpi. To ensure the best possible resolution for type and images.

3 All photographic art must be prepared as RGB

4 All blends and spot colors must be specified as RGB

B. WORKMANSHIP:

1 All spot colors to match control samples as provided in submittals above.

2 All blends should appear smooth with no evidence of “stepping”.

3 Type and photographs should be as sharp as technically possible.

C. DELIVERABLES:

1 The Exhibit Designer will furnish all digital files, typically at full scale with appropriate crop marks.

2 All placed photographic images provided shall be prepared as RGB files at 400 dpi at final size to ensure the best possible resolution.

3 In some cases, FPO art shall be provided in the production files. In this case, Original Art shall also be provided in the form of transparencies, or reflective art or digital files. Exhibit Fabricator will then scan Original art per the specifications above and replace images exactly for final output.

4 Instruction boards and/or elevations provided by Exhibit Designer will include production notes, dimensions and reference codes used in drawings and schedules.

5 Exhibit Fabricator shall notify Exhibit Designer if there are any problems or discrepancies between the graphic elevations for production and the digital files provided.

2.5 COORDINATION / NOTIFICATION

A. Due to the close dimensional tolerances required to successfully execute the Work, Exhibit Fabricator shall closely coordinate photo panel sizes, locations, and mounting hardware with all adjoining work. If any dimensional discrepancies are found, Exhibit Fabricator shall notify Exhibit Designer before proceeding with the Work affected.

B. Exhibit Fabricator shall notify Exhibit Designer if original material is scratched or otherwise damaged in any way which would appear in the produced photograph, before proceeding with production of that image.

C. When proofs are pulled, as per requirements under Submittals above, Exhibit Fabricator shall notify Exhibit Designer if there are any problems or discrepancies between the Graphic Elevations for Production and the Digital Image output.

2.6 INSPECTION

A. Exhibit Fabricator shall afford the Exhibit Designer access to facilities for inspecting the graphic work before, during, and after the production stage throughout the course of fabrication Exhibit Fabricator shall give five days notice to the Exhibit Designer before work is ready for inspection.

B. Exhibit Fabricator to alert Exhibit Designer of any conflicts between panel hardware and applied graphics prior to fabrication.

2.7 OWNERSHIP OF GRAPHICS

A. All graphics-related products required shall become the property of the Exhibit Designer upon completion of the project and shall be transmitted to the Exhibit Designer at no additional cost. This includes, but is not limited to:
   1 Photographic Products
   2 Digital Production Files Exhibit Fabricators and Exhibit Designers

PART 3 PART - EXECUTION

3.1 PREPARATION:

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Coordinate work of this Section with related work of other sections.

3.2 PROTECTION:

A. During shipping and on-site storage, the Exhibit Fabricator shall ensure that all Digital Output panels will be adequately protected with bubble-wrap and cardboard corner protectors (for individual panels) up to the point of installation. The Exhibit Fabricator shall also ensure that all Digital Output panels will be handled in such a way that they will be perfect and unmarred when installation is complete.

3.3 LABELING:

A. All Digital Photo panels shall be appropriately labeled in a concealed place with the graphic reference number as provided on the mechanicals, photography or art.

3.4 FABRICATION

A. Digital files must not be reduced in resolution from their original size during any print process.

3.5 ORIGINAL PHOTOGRAPHY AND ART

A. The position and size of each photo panel will be specified in the Drawings and Schedules to be provided by the Exhibit Designer. Image crops will be specified on the cropping guides provided by the Exhibit Designer.

B. The Exhibit Designer shall supply all original material in the form of color or black and white transparencies and/or negatives and original artwork. Each of these items to print will be marked with a reference number, as well as reference numbers of the loaning photographer or institution. In all cases, these numbers must be used as reference for production and should remain intact. All acetate sleeves, covers, envelopes, etc. associated with each original must be kept with it and returned to the Exhibit Designer. Specific cropping information will be provided with each original and shall be returned with the original to the Exhibit Designer.

C. IMAGES

1 Images on graphic panels to be provided by Exhibit Designer as final hi-resolution RGB images unless otherwise indicated by Exhibit Designer.

2 For larger images and murals, images will be provided to the Exhibit Fabricator in each graphic layout as low-resolution FPO (for Position Only) files. Exhibit Fabricator shall replace FPO images with hi-resolution versions of the same image.

3 Exhibit Fabricator should allow for high-resolution scans to be made from Exhibit Designer's original photography and artwork in the quantities indicated on the Graphic Elevations. Exhibit Fabricator shall allow for approximately fifty (50) high-resolution scans to be made from the Exhibit Designer's original photography and artwork, to be used for photo panels.

4 Digital images will be provided to the Exhibit Fabricator in the form of slides, transparencies, prints, negatives, books, and original artwork. Exhibit Fabricator shall scan images at the appropriate resolution required for optimum results: at final size, images shall have a resolution of 400 dpi or greater.

5 The Exhibit Designer shall supply all original material for high-resolution scanning. Each of these items to scan will be marked with a reference number, as well as reference numbers of the loaning photographer or institution. In all cases, these numbers must be used as reference for production and should remain intact. All acetate sleeves, covers, envelopes, etc. associated with each original must be kept with it and returned to the Exhibit Designer.

6 Exhibit Fabricator shall allow Exhibit Designer's graphic designer forty-eight (48 hours console time at Exhibit Fabricator’s production facility to assemble and manipulate large Digital Files in Photoshop as required).

7 Image crops will be indicated by the FPO images in the Digital Files, and on Graphic Elevations provided by Exhibit Designer.

3.6 MOUNTING

A. METHOD: Exhibit Fabricator shall drymount Digital Output Inkjet Panels to substrate with Optimount Mounting film or approved equal. Print paper shall be wrapped onto back of the substrate panel at all panel edges, and corners neatly folded. Wrapped panel shall then be covered with UV protective film, also wrapped onto the back of the panel. Where back of

panel is visible, apply a finish backing as indicated in the Drawings and Schedules, and as specified in this document.

B. WORKMANSHIP:

1 Where mural require multiple strips of photo paper on same substrate, joint between adjacent strips shall be hairline tight, image perfectly aligned across joint, and color consistent across joint. Exposed edges of paper at joint shall be touched up as required with waterbased marker to match adjacent color values.

2 Where mural is divided into multiple panels, photopaper and protective film shall be wrapped to inside face of panel joints. Image shall be perfectly aligned across joint, and color consistent across joint

3 All materials shall be applied with roller press, and shall be free and clear of dust particles, air pockets and creasing of any kind.

3.7 INSTALLATION

A. Exhibit Fabricator shall remove and replace any work found defective after installation at no additional cost to the Exhibit Designer.

B. Exhibit Designer retains the right to reject any panels after installation that do not meet the requirements above.

C. Exhibit Fabricator shall afford the Exhibit Designer's graphic designer access to facilities for inspecting the graphic work before, during, and after the production stage throughout the course of fabrication. Exhibit Fabricator shall give one month's notice to the Exhibit Designer before work is ready for inspection.

D. Exhibit Fabricator to alert Exhibit Designer of any conflicts between panel hardware and applied graphics prior to fabrication.

E. Exhibit Fabricator shall remove and replace any work found defective after installation at no additional cost to the Exhibit Designer.

3.8 CLEANING

A. Upon completion of the work and when all danger of damage to graphics and photographs is past, Exhibit Fabricator shall inspect and clean all work contained in this section to the satisfaction of the Exhibit Designer.

END OF SECTION

SECTION 10300—PHOTOMURALS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 WORK INCLUDED

A. The Exhibit Fabricator shall furnish all graphic production, labor, materials, equipment, etc., necessary to produce and install all Digital Color Photo Print Panels (hereinafter referred to as Digital C-prints.

1.3 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: Submit manufacturer's, fabricator's and finisher's specifications and installation instructions for each product.

C. Shop Drawings: Prior to fabrication and/or purchase prepare shop drawings of work and submit to and obtain designer's approval thereof. Shop drawings shall be based on drawings, specifications and field measurements essential for proper fitting of Photomurals with other construction or existing architecture, and shall present complete information as to illustrate for the contractor the general character of the Photomurals. Actual artwork to produce Photomurals will be provided by the Exhibit Designer as digital files

D. Samples:

1 Contractor shall submit for approval one (3) completed samples of each photo-panel type. These shall be submitted as complete assemblies, wrapped with specified protective film.

2 Contractor shall submit for approval (3) or more test strips for each type of Photomural with a cropped image of area of 3" or more in height and width. Test strip shall be 12" x 12". Area to be tested shall be selected by Exhibit Designer. Exhibit Designer shall provide photo originals.

1.4 PRODUCT HANDLING

A. Contractor shall protect Photomurals against dampness during and after delivery and while installation is underway.

B. Contractor shall protect Photomurals from surface damage, scratches and abrasion during installation of exhibits. Contractor shall replace all damaged Digital Photo panels that cannot be touched up to the satisfaction of the Exhibit Designer. Contractor shall replace damaged work prior to final acceptance by the Exhibit Designer at no additional cost to the Owner.

PART 2- PRODUCTS

2.1 SUBSTRATES:

A. Gypsum Wall board, 3/8-inch or 3/16-inch Medite II medium-density fiberboard, 3/16-inch or 1/16-inch Plexiglas, or other substrate as indicated in the Graphic Panel Schedule. At Contractor's option, Contractor may use Masonite tempered presswood for panels that are not in case interiors.

2.2 FILMS:

A. PROTECTIVE FILM: Seal Print Shield, satin finish, as manufactured by Seal Products Incorporated, Naugatuck, CT 06770

B. ADHESIVE FILM: "Optimount", as manufactured by Seal Products Incorporated, Naugatuck, CT 06770

2.3 ORIGINAL PHOTOGRAPHY AND ART

A. The position and size of each photo panel will be specified in the Drawings and Schedules to be provided by the Exhibit Designer. Image crops will be specified on the cropping guides provided by the Exhibit Designer.

B. The Exhibit Designer shall supply all original material in the form of color or black and white transparencies and/or negatives and original artwork. Each of these items to print will be marked with a reference number, as well as reference numbers of the loaning photographer or institution. In all cases, these numbers must be used as reference for production and should remain intact. All acetate sleeves, covers, envelopes, etc. associated with each original must be kept with it and returned to The Exhibit Designer. Specific cropping information will be provided with each original and shall be returned with the original to the Exhibit Designer.

2.4 PRODUCTION

A. METHOD:

1 Digital files as provided by the Exhibit Designer must not be altered without notification.

2 Digital files that require rasterization in PhotoShop must be rasterized at 400 dpi. To ensure the best possible resolution for type and images.

3 All photographic art must be prepared as RGB

4 All blends and spot colors must be specified as RGB

B. WORKMANSHIP:

1 All spot colors to match control samples as provided in submittals above.

2 All blends should appear smooth with no evidence of “stepping”.

3 Type and photographs should be as sharp as technically possible.

C. DELIVERABLES:

1 The Exhibit Designer will furnish all digital files, typically at full scale with appropriate crop marks.

2 All placed photographic images provided shall be prepared as RGB files at 400 dpi at final size to ensure the best possible resolution.

3 In some cases, FPO art shall be provided in the production files. In this case, Original Art shall also be provided in the form of transparencies, or reflective art or digital files. Contractor will then scan Original art per the specifications above and replace images exactly for final output.

4 Instruction boards and/or elevations provided by Designer will include production notes, dimensions and reference codes used in drawings and schedules.

5 Contractor shall notify designer if there are any problems or discrepancies between the graphic elevations for production and the digital files provided.

2.5 COORDINATION / NOTIFICATION

A. Due to the close dimensional tolerances required to successfully execute the Work, Contractor shall closely coordinate photo panel sizes, locations, and mounting hardware with all adjoining work. If any dimensional discrepancies are found, Contractor shall notify Designer before proceeding with the Work affected.

B. Contractor shall notify Designer if original material is scratched or otherwise damaged in any way which would appear in the produced photograph, before proceeding with production of that image.

C. When proofs are pulled, as per requirements under Submittals above, Contractor shall notify Designer if there are any problems or discrepancies between the Graphic Elevations for Production and the Digital Image output.

2.6 INSPECTION

A. Contractor shall afford the Architect or exhibit designer access to facilities for inspecting the graphic work before, during, and after the production stage throughout the course of fabrication Contractor shall give five days notice to the Architect before work is ready for inspection.

B. Contractor to alert designer of any conflicts between panel hardware and applied graphics prior to fabrication.

2.7 OWNERSHIP OF GRAPHICS

A. All graphics-related products required shall become the property of the Architect upon completion of the project and shall be transmitted to the Architect at no additional cost. This includes, but is not limited to:

1 Photographic Products

2 Digital Production Files Contractors and Exhibit Designers

PART 3PART - EXECUTION

3.1 PREPARATION:

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Coordinate work of this Section with related work of other sections.

3.2 PROTECTION:

A. During shipping and on-site storage, the contractor shall ensure that all Photomurals will be adequately protected with bubble-wrap and cardboard corner protectors (for individual panels) up to the point of installation. The contractor shall also ensure that all Photomurals will be handled in such a way that they will be perfect and unmarred when installation is complete.

3.3 LABELING:

A. All Photomurals shall be appropriately labeled in a concealed place with the graphic reference number as provided on the mechanicals, photography or art.

3.4 FABRICATION

A. Digital files must not be reduced in resolution from their original size during any print process.

3.5 ORIGINAL PHOTOGRAPHY AND ART

A. The position and size of each photo panel will be specified in the Drawings and Schedules to be provided by the Exhibit Designer. Image crops will be specified on the cropping guides provided by the Exhibit Designer.

B. The Exhibit Designer shall supply all original material in the form of color or black and white transparencies and/or negatives and original artwork. Each of these items to print will be marked with a reference number, as well as reference numbers of the loaning photographer or institution. In all cases, these numbers must be used as reference for production and should remain intact. All acetate sleeves, covers, envelopes, etc. associated with each original must be kept with it and returned to the Exhibit Designer. Specific cropping information will be provided with each original and shall be returned with the original to the Exhibit Designer.

C. IMAGES

1 Images on graphic panels to be provided by Designer as final hi-resolution RGB images unless otherwise indicated by Exhibit Designer.

2 For larger images and murals, images will be provided to the contractor in each graphic layout as low-resolution FPO (for Position Only) files. Contractor shall replace FPO images with hi-resolution versions of the same image.

3 Contractor should allow for high-resolution scans to be made from Exhibit Designer's original photography and artwork in the quantities indicated on the Graphic Elevations. Contractor shall allow for approximately fifty (50) high-resolution scans to be made from the Exhibit Designer's original photography and artwork, to be used for mural-scaled images.

4 Digital images will be provided to the Contractor in the form of slides, transparencies, prints, negatives, books, and original artwork. Contractor shall scan images at the appropriate

resolution required for optimum results: at final size, images shall have a resolution of 400 dpi or greater.

5 The Exhibit Designer shall supply all original material for high-resolution scanning. Each of these items to scan will be marked with a reference number, as well as reference numbers of the loaning photographer or institution. In all cases, these numbers must be used as reference for production and should remain intact. All acetate sleeves, covers, envelopes, etc. associated with each original must be kept with it and returned to the Exhibit Designer.

6 Contractor shall allow Exhibit Designer forty-eight (48 hours console time at Contractor's production facility to assemble and manipulate large Digital Files in Photoshop as required).

7 Image crops will be indicated by the FPO images in the Digital Files, and on Graphic Elevations provided by Exhibit Designer.

3.6 MOUNTING

A. METHOD: Contractor shall drymount photomurals to substrate with Optimount Mounting film or approved equal. Photomural paper shall be wrapped onto back of the substrate panel at all panel edges, and corners neatly folded. Wrapped panel shall then be covered with UV protective film, also wrapped onto the back of the panel. Where back of panel is visible, apply a finish backing as indicated in the Drawings and Schedules, and as specified in this document.

B. WORKMANSHIP:

1 Where mural require multiple strips of photo paper on same substrate, joint between adjacent strips shall be hairline tight, image perfectly aligned across joint, and color consistent across joint. Exposed edges of paper at joint shall be touched up as required with waterbased marker to match adjacent color values.

2 Where mural is divided into multiple panels, photopaper and protective film shall be wrapped to inside face of panel joints. Image shall be perfectly aligned across joint, and color consistent across joint

3 All materials shall be applied with roller press, and shall be free and clear of dust particles, air pockets and creasing of any kind.

3.7 INSTALLATION

A. Refer to the Drawings and Schedules for mounting techniques.

B. Panels shall be installed using one of the following methods, as specified in the Drawings and Schedules:

a. FOAM TAPE: 3/16" thick x 1/2" wide foam tape shall be positioned entirely around the perimeter of the back of the panel one inch (1") in from all edges, and one or more lines of tape at the back of the panel as required for larger panels.
b. ALUMINUM BRACKETS: Painted, brake-folded 3/16" thick x 6" long aluminum brackets shall be bolted to bottom edge of panel, and screwed to underside of veneered rail. Use low-head socket-cap screws where back of panel is visible.
c. BLOCKING: Fasten photo panel directly to exterior back of artifact case or underside of rail with painted wood blocking.

d. CLEATS: Hang photo panel with wood cleats. Adjust depth of cleats and spacers as required to achieve specified alignments.
e. Z-CLIPS: Extruded aluminum z-clips shall be screwed to vertical mounting surface. Where specified in case interiors, matching built-up Plexiglas z-clip sections shall be solvent-adhered to the back of the photo panel. The total assembled clip thickness is not to exceed 1/4".

C. Contractor shall remove and replace any work found defective after installation at no additional cost to the Architect.

3.8 CLEANING

A. Upon completion of the work and when all danger of damage to graphics and photographs is past, Contractor shall inspect and clean all work contained in this section to the satisfaction of the Architect and the Exhibit Designer.

END OF SECTION

SECTION 10500 - ETCHED AND DIMENSIONAL GRAPHICS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 WORK INCLUDED

A. Work included: The Exhibit Fabricator shall furnish all labor, materials, equipment, etc. necessary to prepare and fabricate all the etched and cut metal text and art as shown in drawings, specified herein, or both. The work of this section includes but is not necessarily limited to the following:

1. Sandblasted graphics and letters in Stone
2. Photochemically (acid) etched and filled graphics
3. Lazer cut Letters
4. Dimensional Letters

B. Related Work specified elsewhere;

Section 05500 – Metal Fabrications

1.3 SUBMITTALS

A. Samples:

1. The Exhibit Fabricator shall submit samples of each application, based on graphic production files provided by the Exhibit Designer to verify quality standards to be met. Quantity of samples must be submitted according to the requirements set forth in Section 01330 Submittals. Submittals will include samples;

   a. Land Intro: (3) 12” x 12” samples of sandblasted graphics in granite slab
   b. PW Section Intros: (3) 12” x 12” samples of 1/4” thick steel panels with acid etched letters; non fill stainless steel finish: non-directional No 4. brush surface.
   c. PW Section Intros: (3) 12” x 12” samples of 1/4” thick laser cut letters in steel panels
   d. Gallery Intros: (3) 12” x 12” samples of dimensional letters, paint finish 1/4” acrylic

2. Artwork for use in fabrication of the samples shall be provided by the Exhibit Designer.

A. Site Survey and Shop Drawings: No work may commence until the site survey and all relevant shop drawings have been reviewed and final “Approval with no exceptions” has been granted by the Exhibit Designer. Specifications and Field measurements essential for proper fitting of metal graphic panels with the work of the General Contractor, and shall present complete information as to illustrate for the General Contractor character of the floor graphics and work required to coordinate.

1. Site survey and Coordination Drawings shall be completed by the Exhibit Fabricator to verify the locations of all metal floor graphics (inc. identifiers and donor plaques) and to coordinate the work related to the concrete floor with the General Contractor. Drawings and shall demonstrate;

a) relationship of the work to the floor structure showing elevations and locations of fasteners, anchors and all surrounding conditions.

b) verification of peak identifier locations by sightlines to actual peaks.

c) verification of all dimensions with indication of any discrepancies between actual installation and contract documents,

d) description of sequence of erection.

e) submit certified copies of each survey conducted.

2. Shop Drawings shall clearly illustrate all aspects of the floor graphics including:

a) the relationship of the work to the structure and all surrounding conditions,

b) the arrangement of components,

c) full size details,

d) all dimensions and thicknesses, materials and finishes,

1.4 MATERIALS

A. INK (FILL): Acrylic polyeurathane or such high quality ink to be compatible with the metal surface receiving the fill. All fill colors are baked.

B. PHOTO-RESIST: photo-resistant emulsion for transfering film positive art via UV exposure to metal substrate.

C. PANELS: As indicated in the Graphic Spreadsheets.

D. FINISH: Non-directional finisH: 100 grit/ omni-directional

1.5 PRODUCTION

A. METHOD: All art and text to be output to 100% film positives. Metal surfaces are treated with photo-resist emulsion. Art to be etched is photographically transferred to treated metal surfaces via UV exposure. Art is etched using a controlled-depth acid attack.

1. Etched depth of type and art to range between .015” and .020” for stainless steel

2. Halftone camera-ready art preparation: Harlequine rip; 35 line screen/ Eulcidean dot 45 degree

B. WORKMANSHIP:

1. Edges of art and type to be razor-sharp with absolutely no evidence of bleeding

2. There are to be no mesh marks or saw-toothing.

3. Accurate registration required.

4. All minor imperfections are to be touched-up or cleaned-up, leaving the finished work perfect in every respect.

5. Fill colors to be consistent in color and application and must not bleed past etched area.

6. Etched depths to be consistent.

7. Halftone artwork to be consistent with approved control samples for density and quality.

C. The Exhibit Designer will furnish all camera-ready art work for preparation and etching. Mechanical art shall typically be furnished as film positives at full size, suitable for transfer preparation. All etched art to be output directly from full-scale digital files to1200 dpi Linotronic film or equal. In some cases, over-sized graphics may be output to film negatives at 2400 dpi for enlargement. Art may not be enlarged more than 200% to achieve full size.

D. Instruction boards and/or elevations provided by Designer will include production notes, dimensions and reference codes used in drawings and schedules.

E. When the camera-ready art is produced, Exhibit Fabricator shall notify designer if there are any problems or discrepancies between the graphic elevations for production and the camera-ready art.

1.6 INSPECTION

A. Exhibit Fabricator to inspect all panels prior to installation. Panels to be inspected against signed-off galleys to insure the proper use of fonts, that all graphic elements are present; that color applications are correct; and that all spot-colors match approved control samples.

B. Designer retains the right to reject any panels after installation that do not meet the requirements above.

C. Exhibit Fabricator shall afford Contracting Officer or exhibit designer access to facilities for inspecting the graphic work before, during, and after the production stage throughout the course of fabrication. Exhibit Fabricator shall give five days notice to Contracting Officer before work is ready for inspection.

D. Exhibit Fabricator to alert designer of any conflicts between panel hardware and applied graphics prior to fabrication.

E. Exhibit Fabricator shall remove and replace any work found defective after installation at no additional cost to the Contracting Officer.

1.7 PRODUCT HANDLING

A. Exhibit Fabricator shall protect metal panels against damage during and after delivery and while installation is underway.

B. Exhibit Fabricator shall protect metal panels from surface damage, scratches and abrasion during installation of exhibits. Exhibit Fabricator shall replace all damaged metal panels that cannot be touched up to the satisfaction of the Exhibit Designer. Exhibit Fabricator shall replace or retouch damaged work prior to final acceptance by Exhibit Designer at no additional cost to the Designer.

1.8 INSTALLATION

A. Protection: During shipping and on-site storage, the Exhibit Fabricator shall ensure that all metal panels will be adequately protected with bubble-wrap and cardboard corner protectors (for individual panels) up to the point of installation. The Exhibit Fabricator shall also ensure that all metal panels will be handled in such a way that they will be perfect and unmarred when installation is complete.

B. Labeling: All metal panels shall be appropriately labeled in a concealed place with the graphic reference number as provided on the mechanicals, photography or art.

1.9 CONTRACTING OFFICERSHIP OF GRAPHICS

A. All graphics-related products required shall become the property of the Government upon completion of the project and shall be transmitted to Government at no additional cost. This includes, but is not limited to:

1. Artwork
2. Positive and Negative Films
3. Photographic Products
4. Digital Production Files

PART 2 – EXECUTION

2.1 INSTALLATION

A. Exhibit Fabricator shall remove and replace any work found defective after installation at no additional cost to the Contracting Officer.

2.2 ILLUSTRATIONS

1. The Client shall provide original illustrations for silkscreen reproduction. In some cases, the Designer will receive reference art to be re-drawn as line art for etching.
2. Original photographic art to be scanned at the appropriate resolution for etched reproduction
3. Scans to be processed per instructions by Designer, including but not limited to; silhouetting, coloring, inverting, cleaning
4. Original line art shall be appropriately scanned and digitally processed to achieve sharp, clear lines on a white background.

2.3 ETCHING

A. Etching shall be performed on surfaces indicated in the Drawings and the Graphic Spreadsheets.

B. Exhibit Fabricator shall bake all fill colors as required

C. All positive films for etching shall be of proper size and quality .

2.4 CLEANING

A. Upon completion of the work and when all danger of damage to graphics and photographs is past, Exhibit Fabricator shall inspect and clean all work contained in this section to the satisfaction of the Exhibit Designer.

2.5 COORDINATION / NOTIFICATION

A. Due to the close dimensional tolerances required to successfully execute the work, Exhibit Fabricator shall closely coordinate etched metal panel sizes, locations, and mounting hardware with all adjoining work. If any dimensional discrepancies are found, Exhibit Fabricator shall notify designer before proceeding with the work affected.

B. Exhibit Fabricator to notify designer if hardware conflicts with etched graphics.

C. Exhibit Fabricator shall notify designer if original material is scratched or otherwise damaged in any way which would appear in the produced panel, before proceeding with production of that panel.

END OF SECTION

SECTION 10600 – RESIN PANEL SYSTEM

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 RELATED SECTIONS

Section 05500 Metal Fabrication
Section 10000 Silkscreen Graphics

1.3 DESCRIPTION OF WORK

A. The Contractor shall furnish all labor and materials required to produce, transport and install LIFE Resin panel elements as described herein and in the Drawings.

1.4 SUBMITTALS

A. The Exhibit Fabricator shall submit samples to verify quality standards to be met. Quantity of samples must be submitted according to the requirements set forth in Section 01330 - Submittals.

B. Product Data: Submit producer's or manufacturer's specifications and installation instructions for all products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

C. Samples: Provide the following samples to the Exhibit Designer for review and approval prior to commencing with any work;

1. (3) 12 " x 12" samples of Resin panels in each color specified

C. Shop Drawings and Site Survey: No work may commence until the site survey and all relevant shop drawings have been reviewed and final "Approval with no exceptions" has been granted by the Exhibit Designer.

1. A Site Survey and Coordination Drawings created by the Exhibit Fabricator to verify all as built conditions of the raised floor system and coordinate the work related to the Composite Panel System with the General Contractor and shall demonstrate;

a) relationship of the work to the supporting structure, showing plans, elevations, sections.

b) verification of all dimensions with indication of any discrepancies between actual installation and contract documents,

c) description of sequence of erection.

d) submit certified copies of each survey conducted.

2. Shop Drawings shall clearly illustrate all aspects of the Resin Panel System including:

a) the relationship of the work to the structure and all surrounding conditions.

b) the arrangement of components including dimensioned 'true' elevations plans, sections, edge conditions, of each panel component.

c) full size details.

d) all dimensions and thicknesses, materials and finishes.

e) all revisions to shop drawings on resubmissions.

H. Mockup: Before fabricating exhibit woodwork, build mockups for each form of construction and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Build two full size adjoining Resin panels of min. size 4' x 12' each to demonstrate the following;

a) Finishes.
b) Corner and edge conditions.
c) Panel connecting system, fasteners and hardware.
d) Joints between adjoining panels and control joints.
f) Proposed range of aesthetic effects and workmanship.

2. Notify Exhibit Designer one month in advance of dates and times when mockups will be fabricated and installed.

3. Coordinate and Off-Site Progress Meeting as a quality control review of the mock-up as described in Section 01312 - Project Meetings.

4. Obtain Exhibit Designer's approval of mockups before commencing with composite panel fabrication.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: The installer shall have a minimum of seven years fabricating and installing products of this Section.

PART 2 – PRODUCTS

2.1 Varia Eco Resin, Woven Color – 40% post-industrial recycled resin

A. Colors to be from line of greens and are subject to the review and approval of the Exhibit Designer.

B. Approved Supplier:

1. 3 Form
   2300 South 2300 West, Suite B
   Salt Lake City, Utah 84119
   T 801.649.2500
   info@3-form.com
2. Or approved equal

PART 3 – EXECUTION

3.1 RESIN PANEL FABRICATION AND INSPECTION

A All edges and cut outs of Resin panels to be finished and sanded smooth on all sides.

B All panels to be free and clean of scratches and discoloration.

3.2 PREPARATION

A. All surfaces to be clean and dust free.

B. Protect adjacent work areas and finish surfaces from damage during installation.

3.3 INSTALLATION

A. Resin panels are to be fastened to the support structure with mechanical fasteners as specified.

3.4 TOLERANCES

A. Maximum offset from specified plane angles and between : plus or minus 1/4” (6mm) over 8 ft. length.

B. Top and bottom surfaces of adjoining panels shall appear to be continuous with no deviation along edges.

3.5 CLEAN UP

A. All dust and particles created during installation and sandblasting are to be removed from the site.

B. All packaging and shipping materials are to be disposed of and the site cleared of any obstacles.

3.6 PROTECTION

A. Protect all materials in transit and during installation.

B. Remove protective coating and all related materials upon final completion of the installation.

END OF SECTION

SECTION 10900 – TOPOGRAPHIC MODELS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 WORK INCLUDED

A. The Exhibit Fabricator shall furnish all labor, materials, equipment, etc., necessary to produce, transport, and install a topographic Model of Utah and the Intermountain West as described herein and in the Drawings and Reference Materials. Work shall include a cast model with paint finish or digital output with sealed finish. Surface will describe the land contours and vegetation of the area in 3D.

B. The Client will provide digital topographic dataset and graphic production files (in Adobe Illustrator format) for fabrication of the topographic model. Final determination of the graphical information contained is to be determined by The Client Interpretive staff and the Exhibit Designer.

B. Scale is 1:24:000 with vertical distortion. Final determination of allowable vertical distortion and is to be determined by The Client. Interpretive staff and the Exhibit Designer. Extent of the topography as depicted in the Drawings.

1.3 RELATED SECTIONS
Section 06430 Exhibit Woodwork
Section 05500 Metal Fabrication

1.3 SUBMITTALS

A. SAMPLES AND PRODUCT LITERATURE: Prior to selecting a modeling system the Exhibit Fabricator must submit selection quantities described in Section 01330 - Submittal Proceedures, to the Contracting Officer and the Exhibit Designer for review and selection;

1. Samples: (3) 12” x 12” min. samples of three topographic modeling types, materials, finishes and graphic treatments.

2. Manufacturer’s product literature: product descriptions, warrantees, maintenance instructions, etc.

C SHOP DRAWINGS: Prior to fabrication, Exhibit Fabricator shall prepare Shop drawings of Work and submit to and obtain Exhibit Designer's approval thereof. Shop drawings shall be based on Drawings, Specifications, and Reference Materials, and shall present complete information as to fabrication, installation, and proper fitting of the topographic model with other construction or existing architecture, including location and anchorage requirements of any mounting hardware.

C MOCK-UPS: Partial mockup of the topographic model is required as part of a progress review by the Exhibit Designer and The Client’s Interpretive Staff.

1. Build a mockup 24” x 24” to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work to demonstrate the following;

   a) topography and overall form, vertical distortion
   b) surfaces and finishes
   c) graphic content

2. Notify Exhibit Designer one month in advance of dates and times when mockup will be fabricated and ready for review.

3. Coordinate and facilitate a Progress Meeting as a quality control review of the mock-up as described in Section 01312 - Project Meetings.

5. Obtain Exhibit Designer's approval of mockup before commencing with fabrication.

D PROGRESS PHOTOGRAPHS AND/OR VIDEO TAPES: The Exhibit Fabricator shall submit progress photographs or video tapes for Owner's and Exhibit Designer's approval before proceeding with the Work. Upon review, Owner shall have the right to require any modifications necessary in Owner's opinion to achieve topographical accuracy.

1. Photographs and video tapes should be clearly labeled and dated. Images shall be clear and well-lit, with a minimum of background clutter. Topographic Models shall be filmed in their entirety, with close-ups to show detail.

2. Videos or photographs shall be submitted at the following milestones:

   a. After terrain has been fully sculpted
   b. After all painting has been completed

1.4 QUALITY ASSURANCE

A. The Exhibit Fabricator shall be a qualified fabricator with at least seven years proven experience in high-quality museum exhibits of similar scale and complexity as this project.

B. Subcontractors shall be recognized and established companies producing the highest quality, first- class construction and installation of their work in their respective fields.

C. Guarantee of Work:

1. Except as otherwise specified, Exhibit Fabricator shall guarantee his/her work against defects resulting from the use of inferior materials, equipment, or workmanship for one (1) year from the date of Substantial Completion of the Contract, or from full occupancy of the gallery, whichever is earlier.

2. All materials and /or completed fabrications must have a ten year structural service life in the exhibit environments described. Materials must have the capability of resisting any visible damage for a (5) year active service life.

PART 2 - PRODUCTS

2.1 PERFORMANCE STANDARDS

A. All materials used should simulate the natural environments of the given area at 1:25,000 scale. Details should include Highways/ Interstates; waterways; physiographic provinces; and county lines as described in the Reference materials and defined by the Exhibit Designer.

B. Final selection of a specific material must be approved by the Exhibit Designer.

2.2 ACCEPTABLE MANUFACTURERS:

A. Archetype 3D Images Inc
1634 63rd Street Unit 1
Boulder CO 80301
303 449 7646
www.archetype3d.com

B. Solid Terrain Modeling
340 Fillmore Street
Fillmore, CA 93015
800 548-7621
www.stm-usa.com/

C. or approved equal

2.3 MATERIALS:

A. WOODEN SUBSTRATE: Fire rated MDF construction for base. No part of the substrate shall be visible.

B. RESIN OR FIBERGLASS: Finish material for model to be determined based on approved samples. The entire topographic model should be created as one piece unless approved by Exhibit Designer otherwise. If seaming is required there shall be no visible joints or seam once installed and touched up.

C. PAINT/ SEALANT: All coatings to be have VOC levels and allowed to off-gas prior to delivery to the site. The finish shall be durable enough to withstand the touching and scratching of visitors.

PART 3 - EXECUTION

3.1 MEASUREMENTS

A. Exhibit Fabricator shall be responsible for verifying and guaranteeing all critical measurements, including those provided by Exhibit Designer, Contracting Officer, and others. For the purpose of these specifications, critical dimensions shall mean those dimensions which are critical for a proper fit of cast figure to surrounding exhibitry and reproductions. All such dimensions shall be shown on Critical Dimension Sketches.

B. Exhibit Fabricator shall be responsible for verifying dimensions that are required for proper coordination with other work, including but not limited to exhibitry and reproduction

artifacts. In particular, positions of figures' hands shall be closely coordinated to provide a very close and naturalistic fit with any associated reproductions.

3.2 SHOP FABRICATION

A. All exhibits included in the Scope of Work shall be shop fabricated, unless otherwise identified in bid proposal by Exhibit Fabricator.

3.3 COORDINATION BETWEEN TRADES

A. Exhibit Fabricator shall coordinate work to ensure that the Topomodel will fit properly into the space provided by other General Contractor and otherwise fit and are well-integrated with any surfaces they rest on or objects they are touching or holding.

B. Failure of this Exhibit Fabricator to make known his/her own needs and to determine the requirements of others shall not be cause for additional compensation to correct interferences, or for extra work which could have been avoided by proper coordination.

3.4 INSTALLATION

A. Exhibit Fabricator shall provide all mounting hardware required for complete installation. Exhibit Fabricator shall indicate handling points and any vulnerable areas.

3.5 CLEANING

A. The Exhibit Fabricator shall restore any damage which occurred during installation.

B. After a minimum period of one week after final installation, and when it has been determined that all airborne dust has settled the Exhibit Fabricator shall thoroughly clean all components so that there are completely free of dust and debris.

END OF SECTION

SECTION 10950 – DIORAMAS, MODELS AND TAXIDERMY

PART 1 - GENERAL

1.1 GENERAL

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 RELATED SECTIONS

A. Section 06430 Exhibit Woodwork
B. Section 10950 Dioramas
D. Section 09912 Painting

1.3 DESCRIPTION OF WORK

A. The Exhibit Fabricator shall furnish all labor, materials, equipment, etc., necessary to produce, transport, and install (8) dioramas as described herein and in the Drawings and Reference Materials. Work shall include specified flora, fauna and scenery. Taxidermy provided by Owner to be installed in scene as specified. Final diorama content will be a result of discussions between the Owner, fabricator and exhibit designer.

Dioramas include:
1. LIFE Ecosystem Hot Desert
2. LIFE Ecosystem Cold Desert
3. LIFE Ecosystem Montane Forest
4. LIFE Ecosystem Alpine
5. LAKE Shoreline
6. LAKE Wetlands
7. PAST WORLDS Late Cretaceous
8. PAST WORLDS Eocene

Models include:
1. LAKE Birds

1.3 SUBMITTALS

A. PHOTOGRAPHS OF PROPOSED FLAURA: Prior to fabrication, Exhibit Fabricator shall submit photographs of prospective flaura and obtain the Owner's approval thereof.

B. SAMPLES AND PRODUCT LITERATURE: Samples of all material types and related products literature are to be submitted to the Exhibit Designer for approval prior to use.

1. Samples including; quantities described in Section 01330 - Submittal Proceedures, size representative of actual final product.

a. All plant materials by type including grasses, flowers, lichens, leaves, branches, trees, etc

b. All surface treatments such as soil and rock, bark, water (both natural and artificial), etc.

c. All hardware, mounting systems, armatures, etc.

d. All substrates, support systems, etc.

2. Product Manufacturer's Data: product descriptions, materials including VOC content, warrantees, maintenance instructions, etc.

3. Proposed Pest Control and Dessication Systems: For all natural materials used.

C. SHOP DRAWINGS: Prior to fabrication, Exhibit Fabricator shall prepare measured shop drawings of Work and submit to and obtain Exhibit Designer's approval thereof. Shop drawings shall be scaled drawings (plans, sections, elevations and details) based on Drawings, Specifications, and Reference Materials, and shall present complete information as to fabrication, installation, and proper fitting of the Diorama elements within the Exhibit Area indicated, including location and anchorage requirements of any mounting hardware.

D. MOCK-UPS: Partial mockups of each diorama are required as part of a progress review by the Exhibit Designer and The Owner.

1. Build a mockup to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work to demonstrate the following;

   a) topography and overall form
   b) surfaces and finishes
   c) placement of taxidermy and other materials

2. Notify Exhibit Designer one month in advance of dates and times when mockup will be fabricated and ready for review.

3. Coordinate and facilitate an Off-Site Progress Meeting as a quality control review of the mock-up as described in Section 01312 - Project Meetings.

5. Obtain Exhibit Designer's approval of mockup before commencing with fabrication.

E. PROGRESS PHOTOGRAPHS AND/OR VIDEO TAPES: The Exhibit Fabricator shall submit progress photographs for Exhibit Designer's review and approval before proceeding with the Work. Upon review, The Exhibit Designer and Owner shall have the right to require any modifications necessary in their opinion to achieve biological accuracy.

1. Photographs should be clearly labeled and dated. Images shall be clear and well-lit, with a minimum of background clutter. Dioramas shall be documented in their entirety, with close-ups to show detail.

2. Photographs shall be submitted at the following milestones:

   a. After Diorama terrain has been fully sculpted.
   b. After all scenery and flora have been placed and installed.

1.4 QUALITY ASSURANCE

A. The Exhibit Fabricator shall be a qualified fabricator with at least seven years proven experience in high-quality museum exhibits of similar scale and complexity as this project.

B. Subcontractors shall be recognized and established companies producing the highest quality, first- class construction and installation of their work in their respective fields.

C. Guarantee of Work:

1. Except as otherwise specified, Exhibit Fabricator shall guarantee his/her work against defects resulting from the use of inferior materials, equipment, or workmanship for one (1) year from the date of Substantial Completion of the Contract, or from full occupancy of the gallery, whichever is earlier.

2. All materials and /or completed fabrications must have a ten year structural service life in the exhibit environments described. Materials must have the capability of resisting any visible damage for a (5) year active service life.

3. If the Exhibit Fabricator cannot guarantee a certain material or construction that is shown or is specified, or if he/she cannot furnish guarantees that are required, then Exhibit Fabricator shall inform the Contracting Officer and the Exhibit Designer to that effect in the submitted materials.

4. If, within any guarantee period, repairs or changes are required in connection with guaranteed work, which, in the opinion of the Contracting Officer, is rendered necessary as the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, the Exhibit Fabricator shall promptly upon receipt of notice from the Contracting Officer, and without expense to the Contracting Officer or Exhibit Designer place in satisfactory condition in every particular all of such guaranteed work, correct all defects therein.

PART 2 - PRODUCTS

2.1 PERFORMANCE STANDARDS

A. All materials used should simulate the natural environments of the given Diorama. When actual flaura is used it must be properly cleaned, dessicated, treated for pest control and sealed. See NPS Conservation Guidelines for details.

B. Synthetic materials are to have low VOC levels and allowed time to off - gas prior to arrival on site. All colors are to replicate the natural environment.

C. Materials specified herein are intended to establish the standards of quality required for the Work of this Section.

D. Listing of materials herein does not imply their use nor does it eliminate other materials from consideration.

E. Final selection of a specific material for each exhibit element must be approved by the Exhibit Designer and Owner.

2.2 ACCEPTABLE MANUFACTURERS:

A. Taylor Studios

B. Research Casting International

C. or approved equal

2.3 MATERIALS:

A. WOODEN BASE: Fire rated plywood or MDF construction for base and structure of Dioramas to be engineered for supporting the weight of Figures and Taxidermy.

B. SCULPTED TERRAIN: Terrain is to be sculpted to match the Drawings and Reference materials. Final products and finishes used are to be submitted and approved by Exhibit Designer.

C. WATER: Water elements are to be cast with clear resin and have no scratches or surface imperfections. There shall be no air dubbles or clouding.

D. FLORA: Flora elements will be either cast from actual approved artifacts or sculpted from a core of twisted wire or polyester rope.

1. Suggested finish materials for plants and trees are;

a. Polygem Epoxy #4755
b. Urethane –HMP 45.5.

E. MOUNTING ASSEMBLIES: All mounting hardware required for artifcacts and taxidermy are to be supplied and integrated into the Diorama. No hardware or fasteners are to be visible.

PART 3 - EXECUTION

3.1 TIME OF COMPLETION & FABRICATION SCHEDULE

A. Immediately after award of Contract, the Exhibit Fabricator shall prepare an estimated progress schedule for the Work. The schedule shall be related to the entire Project to the extent required by the Contract Documents. This schedule shall indicate the dates for the starting and completion of the various stages of fabrication and shipping and shall be revised as required by the conditions of the Work, subject to the Contracting Officer's approval.

B. Two additional meetings shall be planned after approval of materials to review shop drawings, development of Diorama elements and mock-ups.

3.3 MEASUREMENTS

A. Exhibit Fabricator shall be responsible for verifying and guaranteeing all critical measurements, including those provided by Exhibit Designer, Contracting Officer, and others. For the purpose of these specifications, critical dimensions shall mean those dimensions which are critical for a proper fit of cast figure to surrounding exhibitry and reproductions. All such dimensions shall be shown on Critical Dimension Sketches.

B. Exhibit Fabricator shall be responsible for verifying dimensions that are required for proper coordination with other work, including but not limited to exhibitry and reproduction

artifacts. In particular, positions of figures' hands shall be closely coordinated to provide a very close and naturalistic fit with any associated reproductions.

3.4 SHOP FABRICATION

A. All exhibits included in the Scope of Work shall be shop fabricated, unless otherwise identified in bid proposal by Exhibit Fabricator.

3.5 COORDINATION BETWEEN TRADES

A. Exhibit Fabricator shall coordinate work to ensure that the Dioramas will fit properly into exhibitry by other Exhibit Fabricator and otherwise fit and are well-integrated with any surfaces they rest on or objects they are touching or holding.

B. Failure of this Exhibit Fabricator to make known his/her own needs and to determine the requirements of others shall not be cause for additional compensation to correct interferences, or for extra work which could have been avoided by proper coordination.

3.6 SHIPPING AND HANDLING

A. Exhibit Fabricator shall store, handle, and ship all Dioramas in such a way that they shall be perfect, free of dust and dirt and abrasions, and unmarred when they arrive and are unpacked. Exhibit Fabricator shall securely and safely crate all Dioramas. Crates shall be marked with indications of opening sequence. Crates shall be constructed in such a way as to properly protect the completed figures and any accessories from damage including breakage, scratches and indentations of any sort. Each Diorama shall be adequately protected with bubble-wrap and foam padding, and supported or braced with framework, as required, up to the point of unpacking.

B. All shipments shall be made with a professional shipping company and shall be fully insured. Owner shall be notified of shipment(s) in advance.

3.7 INSTALLATION

A. Exhibit Fabricator shall provide all transportation, lodging, labor, and materials necessary to install the Dioramas.

B. Exhibit Fabricator shall provide all mounting hardware required for complete installation. Exhibit Fabricator shall indicate handling points and any vulnerable areas.

3.8 CLEANING

A. The Exhibit Fabricator shall restore any damage which occurred during installation.

B. After a minimum period of one week after final installation, and when it has been determined that all airborne dust has settled the Exhibit Fabricator shall thoroughly clean all exhibit components so that there are completely free of dust and debris.

C. The Exhibit Designer and the Contracting Officer shall review for acceptance.

END OF SECTION

Eocene Lakeshore: Visitors see a diorama representing the Fossil Lake and its shoreline.

Elements include: Stromatolites creating an undulating vertical wall from the flat bottom of lake to surface, sticking out of water surface by 6-12 inches, white oolitic sand in bottom of lake, insect larvae in water, 2 presbyornis fossil mounts w. nest w. 8 eggs and tracks, crocodile w. nest, 2 bird nests w. goose eggs, bird tracks in mud-cracked surface, crocodile chasing school of fish, hard-shelled turtle (baptymes), softshell turtle, bowfin, crayfish, 2 gars on bottom of lake, baby/young caiman, mosquitoes, damselflies, caddisflies w. eggs on stromatolites, scorpion flies, marchflies, mosquitoes, sycamore, poplar, willow and birch tree leaves, and other characteristic plants and animals/ species associated with the Eocene Lakeshore community.

Elements to Include	Pictorial Reference
Bony fish	
Bony fish	
bowfin	
caddis fly larva	
Caddis fly	
cayman	
Eocene bird tracks	

Goose nest	
Marsh fly	
mosquito	
Oolitic sand	
Poplar leaves	
Birch leaves	
Sycamore leaf	

Willow leaf	
Presbyornis tracks	
Scorpion fly	
stromatolites	

Lower Cretaceous: Visitors see a diorama representing a swampy bayou of the Lower Cretaceous era comprised partially of a running water feature, and so dense with plants that visitors can not see the sky.

Elements include: Deinosuchus lurking in background, small, feathered Troodon scavenging Ceratopsian carcass with maggots, wasps and beetles on it, empty dinosaur nest w. broken eggshell, stream with mud turtle, soft-shell turtle on bank, varanoid lizard sunning on log, small boa-like snake in tree or on log, helodermatid, small shrew-like mammals (Alphadon types), guitar fish, dead gar, dragonflies, moths, butterflies, earwigs, flies, ant nest near stream, fallen sequoia conifer, log grown over with lichen and fungi, dense undergrowth, cones and leaves, and other characteristic plant and animals/identifier species associated with the Lower Cretaceous community.

alphadon	
Ant nest	
Boa snake	
butterfly	
ceratopsian	
Cretaceous scene reference	

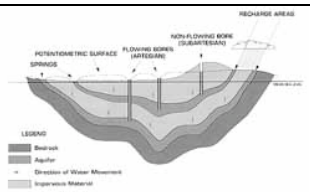
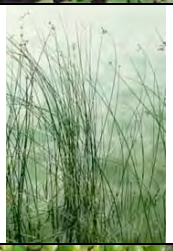
Croc nest	
Crocodile skull	
Deinosuchus skull	
Deinosuchus	
Dragonfly	
Earwig	
Fly	
Gar	
Guitar fish	

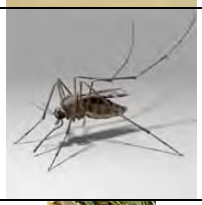
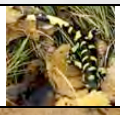
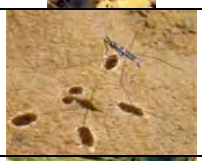
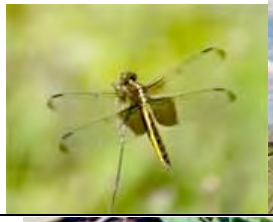
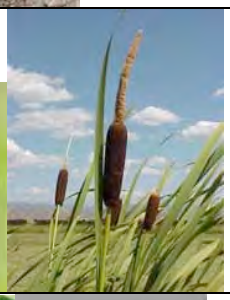
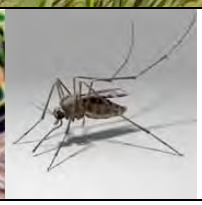
Helodermatid	
Log with lichen fungus	
moth	
troodon	
turtle	

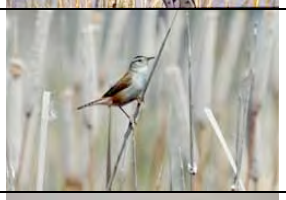
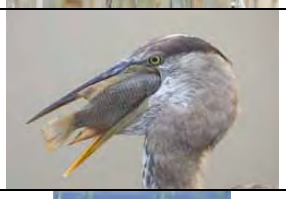
SECTION 10950 – DIORAMAS, MODELS AND TAXIDERMY

Wetlands: Visitors see a diorama representing the wetlands near Great Salt Lake; place reference Bear River Refuge or Shoreline Preserve.

Elements include: Filtration plant/soil cross-section, marsh marigold, bulrushes, duckweed, hornwort, pondweed, rushes, crayfish, mosquitoes, tiger salamander, water strider, diving beetle, heron w. nest, chub and carp, garter snakes, dragonflies perching on cattails, leopard frog eating a mosquito, muskrat eating cattail roots, beaver, mink, yellow-headed blackbird, marsh hawk, marsh wren, egret or heron feeding, eared grebe w/ nest, meadow vole and vole runways/tunnel, and other characteristic plants and animals/identifier species associated with the Great Salt Lake wetlands community.

Plants/Animals in Context	**Pictorial Reference**	**Type (model, taxidermy, etc.)**	**Source (existing UMNH Collections, to be borrowed, to be purchased)**
Filtration plant/soil cross section		model	fabricator
Marsh marigold		model	fabricator
Bulrushes		model	fabricator
Duckweed		model	fabricator
Plants/Animals in Context	**Pictorial Reference**	**Type (model, taxidermy, etc.)**	**Source (existing UMNH Collections, to be borrowed, to be purchased)**
Hornwort		model	fabricator
Pondweed		model	fabricator

Crayfish		model	fabricator
Mosquitoes		model	fabricator
Tiger salamander		model	fabricator
Water strider		model	fabricator
Diving beetle		model	fabricator
Heron w. nest		Taxidermy (heron) Model (nest)	fabricator
Chub and carp		model	fabricator
Garter snakes		model	fabricator
Dragonflies perching on cattails	 	models	fabricator
Leopard frog eating a mosquito		models	fabricator

Muskrat eating cattail roots		Taxidermy (muskrat) model (cattail roots)	fabricator
Beaver		taxidermy	Existing UMNH Collections
Mink		taxidermy	fabricator
Yellow-headed blackbird		taxidermy	fabricator
Marsh hawk		taxidermy	fabricator
Marsh wren		taxidermy	fabricator
Heron feeding		Taxidermy (heron) model (fish)	fabricator
Eared grebe w. nest		taxidermy	fabricator

Meadow vole w. vole runways		Taxidermy (vole) models (runways)	fabricator

SECTION 10950 – DIORAMAS, MODELS AND TAXIDERMY

Shoreline: Visitors see a diorama representing a lake with playa, pickleweed, saltgrass and greasewood zones, and learn how the shores of the Great Salt Lake are home to a multitude of plant and animal species adapted to live in salty areas. Visitors see how different plant species can withstand different levels of salt in the soil, and so tend to be found in zones depending on the concentration of salt. Visitors see that where rainfall has lowered salt levels, certain plants such as iodine bush grow and provide food and shelter for a host of animals of different sizes, and can appreciate how though the playas, salt flats and marshes are not as lush as the wetlands, they can still support diverse food webs.

Elements include: Reconstruction of transect from lake representing pickleweed, saltgrass and greasewood zones, pickleweed, salt grass, salt bushes, greasewood, iodine bushes, inkweed, shadscale, spiders, grasshoppers, badger, Savannah sparrows, soil cross section showing tiger beetle burrow and vole runway, vole eating a Mormon cricket, avocets feeding, Northern harrier flying overhead, harrier nest, fox menacing snowy plover nest, and other characteristic plants and animals/identifier species associated with the lake community.

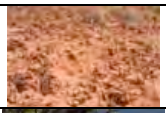
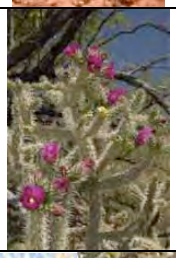
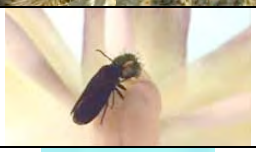
Location	Plants/Animals in Context	Pictorial Reference	Type (model, taxidermy, etc.)	Source (existing UMNH Collections, to be borrowed, to be purchased)
	Pickleweed		models	
	Saltgrass		models	
	Greasewood		models	
	Salt bush		models	
	Greasewood		models	

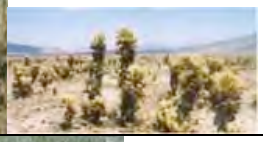
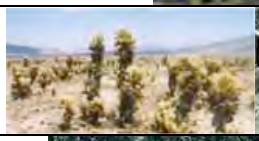
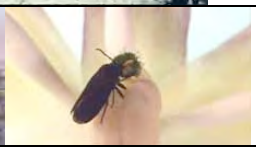
	Iodine bush		models	
	Inkweed		models	
	Shadscale		models	
	Spiders		models	
	Grasshoppers		models	
	Badger		taxidermy	
	Savannah sparrows		taxidermy	
	Soil cross section showing tiger beetle burrow and vole runway		models	

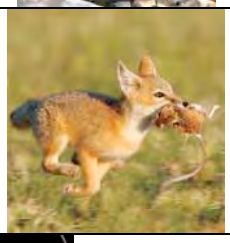
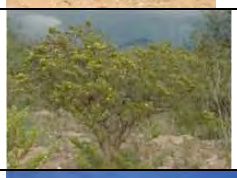
	Vole eating a Mormon cricket		Taxidermy (vole) model (Mormon cricket)	
Location	Avocets feeding		taxidermy	
	Northern harrier flying overhead		taxidermy	
	Harrier nest		model	
	Fox menacing snowy plover nest		Taxidermy (fox) model (nest)	

Hot Desert Mojave (Summer): Visitors see a diorama representing the Beaverdam Wash area of Southwest Utah, anc learn how the extremes of heat and water availability affect the animals and plants that live in deserts. Visitors see up close the interdependencies of this ecosystem (cryptobiotic soils, plant and insect pollination) and appreciate its fragil nature. Soundscape will give visitors a sense of nighttime inhabitants vs. daytime inhabitants.

Groundform description: flat and sandy

Location	Plants/Animals in Context	Pictorial Reference	Type (model, taxidermy, etc.)	Source (existing UMNH Collections, to be borrowed, to be purchased)
Close up/magnify	cryptobiotic soil		model	fabricator
	cholla cactus w. inset trap		models	fabricator
	cactus wren and nest		taxidermy (wren) model (nest)	fabricator
	yucca flower and moth		models	fabricator
	lac insect on creosote		models	fabricator
Ground cross section showing	tarantula in burrow		model	fabricator
Very nearground	tarantula and tarantula hawk		models	fabricator

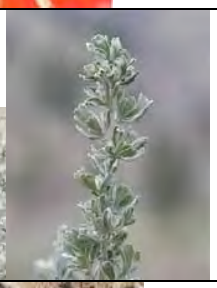
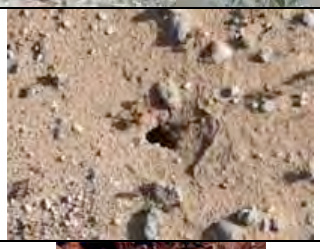
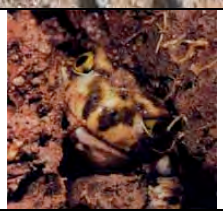
Cutaway	antelope ground squirrel in burrow		taxidermy (squirrel) model (burrow)	fabricator
Nearground	pallid bat eating scorpion		taxidermy (bat) model (scorpion)	fabricator
	desert raven w. pecked juvenile gopher tortoise shell		taxidermy (raven) model (shell)	fabricator
	wren nest in cholla		models	fabricator
Nearground	lupine		models	fabricator
	desert moss		model	fabricator
Near/midground	cholla cactus with wood rat nest at base		models	fabricator
	gopher tortoise eating cactus		models	fabricator
	banana yucca w. yucca moth		models	fabricator

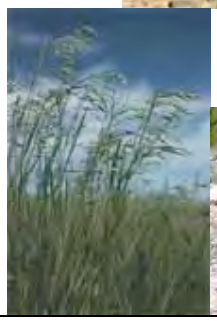
Middleground	barrel cactus		model	fabricator
	coyote or kit fox chasing		taxidermy	fabricator
	desert kangaroo rat (shown in mid leap)		taxidermy	fabricator
	Creosote bush		model	fabricator
Background	Joshua tree with nurse plants		models	fabricator

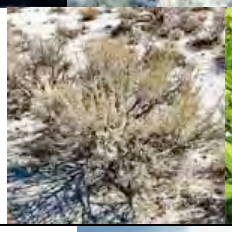
SECTION 10950 – DIORAMAS, MODELS AND TAXIDERMY

Cold Desert: Visitors see a diorama representing a valley/foothill gradient in the Bonneville Basin and learn about the interconnectedness of the plant and animal species that live there. Soundscape will give visitors a sense of nighttime inhabitants vs. daytime inhabitants.

Groundform description: flat with fine soil, porous ground

Location	Plants/Animals in Context	Pictorial Reference	Type (model, taxidermy, etc.)	Source (existing UMNH Collections, to be borrowed, to be purchased)
Close-up/magnify	shadscale leaves		model	fabricator
Close-up/magnify	Broad-tailed hummingbird		taxidermy	fabricator
Very near ground	Mormon cricket feeding on saltbush or sagebrush		models	fabricator
Very near ground	harvester ant hill section showing ants		models	fabricator
Very near ground	Western spadefoot toad in burrow		models	fabricator

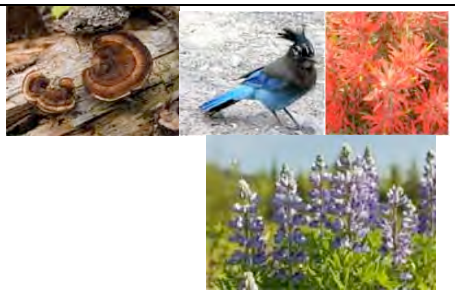
	Short horned lizard eating ants		models	fabricator
	Greater sage grouse		taxidermy	fabricator
Very near ground	Pygmy rabbit hiding under sagebrush		taxidermy	fabricator
	Chisel-toothed kangaroo rat eating shadscale		taxidermy (rat) model (shadscale)	fabricator
Middleground - including tracks of all mammals	pinon cheatgrass Russian thistle		models	fabricator

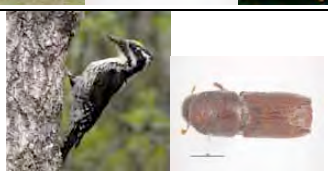
	pronghorn		taxidermy	fabricator
	muledeer		taxidermy	Existing UMNH collections
Background	pinon juniper sagebrush broomrape		models	fabricator
	pronghorn stepping into scene		taxidermy	fabricator

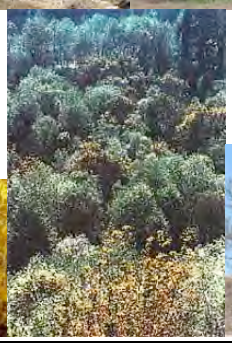
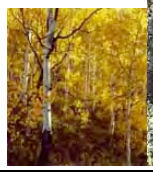
SECTION 10950 – DIORAMAS, MODELS AND TAXIDERMY

Montane Forest: Visitors see a diorama representing a forested canyon on the Wasatch Front and learn about the interconnectedness of plants and animals. Soundscape will give visitors a sense of nighttime inhabitants vs. daytime inhabitants.

Groundform Description: steeply sloping from nearground to background

Location	Plants/ Animals in context	Pictorial Reference	Type (model, taxidermy, etc)	Source (existing UMNH Collections, to be borrowed, to be purchased)
Close-up/magnify	spruce beetle spruce budworm (on fallen spruce log?) nitrogen-fixing bacteria		models	fabricator
Ground cross section showing	lupine rots and nitrogen-fixing bacteria		models	fabricator
Nearground	decomposing log w. shelf fungus, jay on top wildflowers, including lupine		models (all plants) axidermy (jay)	fabricator
Under log	red squirrel, toad and snake underneath		taxidermy	fabricator
	boreal toad		model	fabricator
	red squirrel on log holding cone		taxidermy (red squirrel) model (pine cone)	fabricator
	Uinta chipmunk on ground, in grass		taxidermy	fabricator

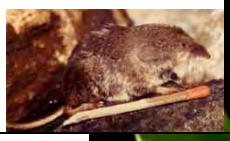
Middleground	spruce with beetle, budworm		models	fabricator
	3-toed woodpecker eating beetles		taxidermy (woodpecker) models (beetles)	fabricator
	oak or maple with galls		models	fabricator
	pine marten and tree squirrel		taxidermy	fabricator
	badger digging after pocket gopher		taxidermy	fabricator
	snowshoe hare		taxidermy	fabricator
	Steller's jay on tree feeding		taxidermy (jay) model (tree)	fabricator

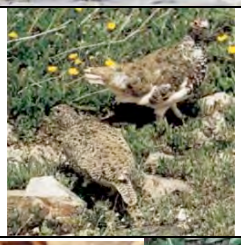
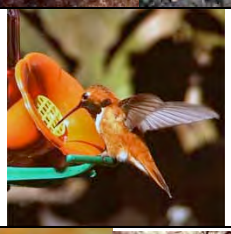
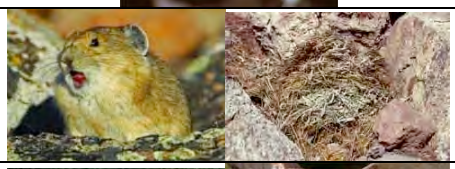
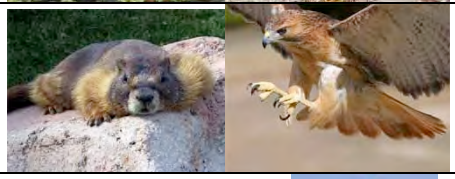
	dropped elk rack		model	fabricator
Background	mountain lion chasing muledeer out of diorama		taxidermy	Existing UMNH Collections
	additional spruce, maples, oak, aspen, alder, mahogany	 	models	fabricator

SECTION 10950 – DIORAMAS, MODELS AND TAXIDERMY

Alpine: Visitors see a diorama representing a rock outcrop, and associated tundra at the edge of the tree line, and learn about the interconnectedness of the plants and animals as well as how they adapt to life at extremely high elevations and low temperatures. Soundscape will give visitors a sense of nighttime inhabitants vs. daytime inhabitants.

Groundform Description of Magnified Area: rock outcrop with talus slope and adjacent tundra

Location	Plants/ Animals in context	Pictorial Reference	Type (model, taxidermy, etc)	Source (existing UMNH Collections, to be borrowed, to be purchased)
Close-up/magnify	lichen		model	fabricator
Nearground	sedge Whitlow grass krumholtz bristlecone pine and cones		models	fabricator
	group of Magdalena Alpine butterflies flying over rockslide		models	fabricator
	shrew eating diptera/spiders		taxidermy (shrew) models (diptera/spiders)	fabricator
	additional diptera/spiders		models	fabricator

	Clark's nutcracker feeding on pine seeds		taxidermy (nutcracker) models (seeds)	fabricator
	white-tailed ptarmigan foraging		taxidermy	fabricator
	dwarf shrew eating insect or spider in talus		taxidermy	fabricator
	Rufus hummingbirds eating out of a penstamon		taxidermy (hummingbirds) model (penstamon)	fabricator
	pika and haystack		taxidermy (pika) model (haystack)	fabricator
Middleground	marmot threatened by golden eagle above		taxidermy	fabricator
Background	mat willow additional krumholtz pine and spruce		models	fabricator
	bighorn sheep		taxidermy	fabricator

SECTION 10960 – INTERACTIVE EXHIBITS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section shall be governed by the Contract Documents. Provide materials, labor, equipment and services necessary to furnish, deliver and install all work of this Section as shown on the drawings, as specified herein and/or as required by job conditions.

1.2 WORK INCLUDED

A. The Work shall include, but is not limited to the following:

1. X2-PW-4.10 Past Worlds Mammoth Puzzle
2. X2-PW-4.20 Past Worlds Herbivor/Carnivor Interactive
3. X3-FP-3.10 First Peoples Table Exhibits
4. X3-LK-4.10 Lake - Wetlands Filtration
5. X3-LK-4.20 Lake - Formation
6. X3-LD-4.00 Land - Erosion Table
7. X3-LD-4.10 Land - Earthquake Simulator
8. X3-LD-4.20 Land - Expansion
9. X4-LF-4.10 Life - Keratin
10. X4-LF-4.20 Life - Plant and Animal Cell Assembly (2 exhibits)
11. X4-LF-4.30 Life - Photosynthesis
12. X4-LF-4.40 Life - Protein Synthesis
13. X4-LF-4.60 Life - Jaw Movement
14. X4-LF-4.70 Life – Speciation
15. X5-SK-4.10 Sky – Heliostat sun table

1.3 RELATED SECTIONS
Section 05500 Metal Fabrication
Section 06430 Exhibit Woodwork

1.4 QUALITY ASSURANCES

A. The fabricator and the installer shall be one of the same firm who can substantiate that the firm has been continuously engaged in the fabrication and installation of electromechanical interactive work similar to that described herein for not less than seven (7)years.

B. Technical design, engineering and prototyping of electromechanical exhibits is the Trade Contractor's responsibility.

1. The Contract Documents are intended to provide performance and esthetic specifications for the design, fabrication and installation of electromechanical exhibits of this Section. This Trade Contractor is responsible for the engineering and design of the components and materials as well as fabrication, installation, and performance of the fabrications.

2. Exhibit design control drawings shown are intended to establish the basic dimensions, finishes, motion, location, connections, and profiles of electromechanical exhibits The Trade Contractor is responsible for the design and engineering of the fabrication within these aesthetic parameters. The drawings are design requirements, unless specifically noted as completely engineered and designed on the drawings.

3. Exhibit design control drawings do not cover some conditions or modifications, which may be required. The Trade Contractor, by accepting this Contract for the Work, acknowledges this and agrees that the Exhibit designer shall have final acceptance of all matters whether detailed or not for the exhibit design details.

C. Engineer qualifications: Professional engineers licensed to practice in Utah and experienced in providing engineering services of the kind required that have resulted in the successful installation of electromechanical exhibits as similar as possible in material, design and extent to that indicated for this Project.

D. All work shall comply with all building and safety codes

E. All electromechanical exhibitry exposed to direct visitor contact or having visitor interface shall be engineered to withstand normal wear and tear of such contact. Contractor shall warrantee in writing all electromechanical exhibits free of defects and able to withstand visitor contact. The period of the warrantee shall be one year. Exhibitry failing to function as specified during this period shall be repaired at the contractor's expense. Contractor shall provide written instructions on the maintenance of all electromechanical exhibits. Owner shall be responsible for providing proper maintenance under the terms of the warrantee.

1.5 SUBMITTALS

A. The Samples and Certificates in the following list are required to be submitted by the Contractor to the Exhibit Designer for review. An omission of an item or items does not relieve the Contractor from this responsibility, and for compliance with the Contract Documents of which this is a part.

SAMPLES

Item No.	Quantity.	Size	Description
S1	4	9" x 9"	Of all sheet materials to be used finished
S2	4	9"long	Of each and all extruded or linear shapes used
S3	4	actual	All fasteners and hardware to be used
S4	4	Documents	Cutsheets, manuals etc. for all equipment

NOTARIZED CERTIFICATES OF COMPLIANCE

Item No.	Description	Standard
C1	All electrical equipment	UL listing

B. Shop Drawings

1. Submit shop drawings for review in accordance with the Contract Documents.

2. Shop drawings shall indicate by plans, elevations, sections and details of the work of this Section, showing in detail large scale construction, methods of installation and attachment, type, size, spacing and location of welds, bolts or other anchorage devices and shall give all pertinent data as to thickness, dimensions and exposed finishes.

3. Shop drawings shall indicate the work which is furnished by this Section and installed by other trades and the work of other trades which adjoin or butt the work of this Section.

4. As requested by the Exhibit Designer provide additional details, sections and calculations to fully describe the work to be provided.

5. Where items, anchorages, inserts are scheduled to be set into the concrete or built into the work by other Trade Contractors for the installation of electromechanical exhibits provide setting drawings, templates, instructions and directions for their installation. Coordinate delivery with other work to avoid delay of job progress.

C. Product Literature

1. Submit product literature to Exhibit Designer for review in accordance with the requirements of the Contract Documents.

2. Submit printed manufacturer's literature, data sheets and/or catalog cuts for all items which are pre-manufactured and will be provided as part of the work.

D. Prototype

1. Prior to installation all interactives shall be testing and reviewed by Exhibit Designer and Owner.

2. Fabrication schedule should be planned so that four weeks are allowed for prototyping and testing prior to installation.

1.6 DELIVERY, STORAGE & HANDLING

A. Deliver materials to the job ready for use, and fabricated in as large sections and/or assemblies as practical. Assemblies shall be identical to the reviewed submittals.

B. Store materials under cover in dry and clean locations off the ground. Take every precaution not to damage or mar prime coats and/or galvanizing. Remove materials which are damaged or otherwise not suitable for installation from the job site and replace with acceptable materials at no additional cost.

PART 2 - PRODUCTS

2.01 FABRICATION - GENERAL REQUIREMENTS

A. Workmanship and finishes shall be first class in every respect and in accordance with the best practices. Employ skilled workers in the fabrication and erection of this work.

PART 3 - EXECUTION

3.01 PREPARATION

A. As per Divisions 5, 6, 8, 9, and 16

3.02 EXAMINATION

A. As per Divisions 5, 6, 8, 9, and 16

3.03 INSTALLATION - GENERAL

A. As per Divisions 5, 6, 8, 9, and 16

3.04 CLEANING AND PROTECTION

A. Protect installed work using adequate and suitable means during and after installation until acceptance.

B. Repair, remove and/or replace surfaces and materials which become marred, scratched, bent or damaged in any way.

C. Clean surfaces of grime and dirt using acceptable and recommended means and methods. Take care not to damage, mar or stain adjacent materials.

END OF SECTION

UMNH Live Animal Displays
Provider: Animal habitats and live display by live display consultant under XC scope

Area	Description of Habitat	Live specimens	Size of habitat	Habitat Specifications: Wet-dry, Sand, earth, substrate, etc. Plants	Maintenance Requirements: Access, lighting, filtration, heat
OB	Live insect zoo-mounted cases on wall or cases on shelves	Black widow	1 gallon max.	In woodpile	
		Wolf Spider	1 gallon	Mimic natural environment- local rocks can be sterilized, sand, etc.	During day- lights can be low, bright lights at night. Lighting is primarily to enable public viewing. Food- worms, crickets, roaches
		Tarantula	1 gallon	Utah varieties are small and females have 15 yr. life span	
		Jumping Spider	1 gallon		
		Centipede	1 gallon		
		Jerusalem Cricket	1 gallon		
		velvet ants	1 gallon		
		beetle	1 gallon		
		desert hairy scorpion	1 gallon		
		Mormon cricket	1 gallon		
		Praying mantis	1 gallon		
	Walls of "underground" crawlspace contain inset terrariums	King Snake	120 gallon- 48" x 24" x 25" H	Needs some rocks in his habitat to hide under	Heating important- caloric heat tape can be used to gradually heat environments. Spec thermostat as part of this system. (approx. $300) Red light, blue lights or led's can be used to illuminate. Lights are to enable visitor viewing. UVA and UVB lights can be used in back of house. Brandon (Impersonature)
		Collared Lizard	40 square- 40" x 40" x 18" H	Require hiding places in habitat	
		Ant Colony	5 gallon tank dimensions 24" x 24" x 17" H		
	Pond-side animal habitat- terrariums with round wall openings	Woodhouse Toad	120 gallon- 48" x 48" x 25" H	Collection of these is highly regulated- suggestion to get juveniles from captivity and breed them.	
		Boreal Toad Chorus Frog	120 gallon- 48" x 48" x 25" H	Size contingent on both species	
		Tiger salamander	40 square- 24" x 24" x 17" H		

Lake	Winogradsky columns-South	Brine Shrimp	5' x 1' diameter tube		Brine shrimp use light as focal point, otherwise remain quite static. Suggestion to light tube on back and/or from the bottom. Heat tape could also be used here. Aerator required below & holes on top. Changeout of 50% of the water twice a week. Moderating temperature and not overfeeding are critical to brine shrimp's survival.
	Winogradsky columns-North	Halococcus Bacteria	5' x 1' diameter tube. double wall allows 1' area for sediment growth		Ideally, lighting will run vertically behind the tube and light the entire structure. Power compact lighting is important if algae is to be visible. Aeration will help things move around.
Life	Problem of Size section-1/2 globe shaped terrarium	Tarantulas (with past molts displayed)	Drawn as 30" diameter	Dry environments, ground dwelling. Brandon suggested Mexican red leg variety or Antilles pink toe, both examples of terrestrial types that live on the ground.	
	Population section- inset wall case	Colony of seed harvester ants	Drawn as 30" x 18" x 10' h	Thin walled sides and flat area on top	
	What Populations Do-1/2 globe shaped aquarium	Stickleback fish	Drawn as 30" diameter		Hide filtration system with plants, canister filter would be ideal- water runs through mechanical and chemical filtration. Impersonature suggested Fluval or Eheim as canister system sources.
	Economy of Life area-tube shaped terrarium	Photosynthesis Interactive-Algae growing with sunlight from heliostat	5' x 1' diameter tube		
Land	Colorado Plateau-glassed in environment	Pothole Crustaceans	Drawn as 2' diameter pothole, 5" deep	Need stabilized temperature, triops are very carnivorous and will live an average of 30-45 days.	Access from below.

SECTION 10980 – SOLAR INSTRUMENTS

EXHIBIT FABRICATOR EQUIPMENT LIST

Category	Company/Contact	Product Name/Model No.	Description
Heliostat	DFM Engineering, Inc. Longmont, CO 80501 (303) 678-8143	Custom design	DFM suggests purchasing an engineered package designed specifically for UMNH. All instruments are made to order. Combination spectrascope/heliostat.
	Practical Solar David Howell (617) 464-1770 Practicalsolar.com	Heliostat	Maltbie's recommendation- A system consists of the control software, a driver box, and anywhere from 1-200 heliostats. Each heliostat is individually targeted and controlled by the software.
	Exploratorium (415) 353-0432 kpatten@exploratorium.edu	Heliostat	A mirror tilts to be reflecting sunlight continuously. Revolves by clockwork. Collected sunlight can be used in other exhibits.
	Colt International www.Bomin-Solar.de	Lightron	Functions using mirrors to direct sunlight to a desired location.
	Possible donation from Liberty Science Center (201) 200-1000		Heliostat and sun image exhibit
Projection Telescope	Meade MX90 or 200, 8"-12"	Projection telescope	Telescope for projecting image of the sun from heliostat/ mirror on the roof to tabletop display. Hydrogen Alpha filter is required to enhance features and Mylar filter can be added to cut light so no risk of heat / fire. Can be attached on a pier mount tied to the structure so full isolation platform is not required.
Mirror Glass		Mirror Glass (beamsplitter) 3 mirrors estimated	Splits light from heliostat to projection telescope, solar tube and sun paintings

SECTION 10980 – SOLAR INSTRUMENTS

Category	Company/Contact	Product Name/Model No.	Description
Solar Tube	The Sun Pipe Co., Inc., P.O. Box 5760, Elgin, IL 60121	The Original Sun Pipe	Life exhibit: allows natural light to reach indoor spaces using ceiling diffusers.
	Parans Kampegatan 4, 411 04 Goteborg, Sweden, www.parans.com		Solar panel mounted on roof uses optical lenses to collect and concentrate incoming sunlight. Tubes take light to different areas of the building.
Sun image	Exploratorium (415) 353-0432 kpatten@exploratorium.edu	Sun image exhibit	A pinhole aperture placed in a beam of sunlight casts an image of the sun onto a black wall or a screen. Image shows solar features, including sunspots.
		Sun painting	A heliostat reflects light into an indoor exhibit space. A rainbow of refracted and reflected light is created using prisms, etc.
Weather Station	TimeScience LLC 801-554-9296 tim@time-science.com www.TimeScience.com	TimeScience TimeWindow	A time-lapse system to record from one or more cameras and play the footage back at high speeds. Could record Salt Lake have additional cameras set up in other areas of interest (ex: Zion or Bryce Canyons).

SECTION 11130 AUDIO-VISUAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Scope of Work

1. Prepare shop drawings and other submittals for review by the exhibit design team prior to construction.

2. Furnish and install audio-visual systems as shown on the project drawings and described in this specification. The drawings and specifications do not describe all work required to fulfill the contract. In addition, provide any additional equipment, materials and labor required to make complete and working systems consistent with the intent embodied in the project drawings and specifications.

   a. Provide all necessary connectors, terminals, punch blocks, patch bays, connector panels, and cover plates.

   b. Provide all necessary conduit, surface raceway, boxes, wire and fiber except those items specifically listed as work by others.

   c. Provide all equipment required to meet the performance requirements defined in the AV design documents.

3. Coordinate installation of AV Systems with the work of the General Contractor as defined in Div 16 and other Sections

4. Coordinate installation of AV System with the work of the exhibit fabricator and media producers.

5. Terminate of all wiring at panels, terminal closets and equipment racks.

6. Test all installed cabling and equipment.

7. Prepare as-built documents.

8. Provide on site training in the operation and maintenance of the systems for personnel designated by the museum

9. Provide a one-year warranty covering all systems installed under this specification

B. Related Work

1. Division 16: Conduit, raceway and standard electrical boxes shall be provided by General Contractor. Control wiring to dimmers shall be terminated at the dimmer end. All 120 VAC circuits for A/V, teleconferencing, and network devices

2. CAT5 and fiber optic cables, jacks and patch bays for connection of AV systems to building LAN.

1.02 REFERENCES

A. Codes

1. Federal, state, and local codes and requirements.

B. Standards:

1. CSA, UL or other nationally recognized testing laboratory standards.

C. Code compliance is mandatory. Inform the owner if work is shown that appears to conflict with codes.

1.03 SYSTEM DESCRIPTION

A. General: Provide audio-visual systems for sound playback, video projection, computer graphics display, and AV interactive elements

B. The system consists of the following exhibits and alternates

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Exhibit Name	Ref	notes
CANYON		
Trail Head	CN4.E01.av01-06	(6x) 17" touchscreen, CPU , (1) CPU & laser printer in gift shop
Trail System	N/A	Server & Software for Smart Phone System
SKY		
Weather Station	SK2.E06	46" monitor,CPU (Instrument N.I.C.), split screen ctrl
Snowflake Video	SK3.E01.av02	20" AV monitor, S-Def, speaker

NATIVE VOICES		
Storytelling	NV6.E01.av01-04	MP3 w/ focused spkr (4) caption reader
Generational Memory	NV5.E06.av01	46" AV monitor, S-Def, soundsticks
Welcome	NV1.E01.av01	MP3 player, speaker, motion sensor
Language Station	NV3.E01.av01	CPU, 17" monitor, KBD / trackball, headphones
LIFE		
Keritan Interactive	LF2.EO2	(24) 2" 5x7 LED displays & electronics
What Cells Can Do	LF3.E02.av01	Video projector, S-Def, focused spkr
Ecosystems	LF6.E01-E04.av01	(4x) 4 Sprk. Soundscape
Human Interactions	LF6.E05.av01	(4) handsets w/ buttons
Talkback Station	LF6.E05.av02	CPU, 12" monitor w/ kbd station
THE LAND		
Plate Tectonics	LD1.E03.av01	Globe on/off control only
Plate Tectonics		Allowance for 32" Omni Globe
Human Interactions	LD4.E04.av02-05	(3) small speakers w/ buttons
B&R Biogeography	LD4.E08.av01	26" AV Monitor, S-Def,
Talkback Station	LD4.E04.av01	CPU, 12" monitor w/ kbd station
Seismograph	LD4.E03.av01	CPU, 15" monitor,
Jump Seismometer	LD4.E03.av.02	26" monitor allowance, exhibit OFE
FIRST PEOPLES		
Ceramics, Tools, Weaving	FP5.E02.av01 FP5.E05.av01 FP5.E06.av01	(3x) 20" AV monitor S-Def w/ sound
LAKE		
Sounds of the Lake	*LK2.E01.av01*	(8) speaker soundscape
Watershed	*LK2.E06.av01*	46" AV Monitor, S-Def, speakers
People and the Lake	*LK2.E05.av01*	46" AV Monitor, S-Def, speakers
PAST WORLDS		
Paleo Prep	PW7.E01.av01	20" AV monitor, S-Def, w/ sound
Cleveland Lloyd Quarry	PW5.E03.av01	(4) 20" AV monitor, S-Def, w/ sound
Late Cretaceous	EX	(6) speaker soundscape
UTAH FUTURE		
Sustainability (basic)	UF3.E01.av01	single 10K LCD, 15 gobo & sensor
Audio Talkback Station	UF3.E01.av02	CPU, 12" monitor spkrs, microphone
OUR BACKYARD		
Our Backyard Animal Sounds	OB2.E01.av01	(5x) MP3 players & speakers

Media Playback to learning labs	3 ch SD media server
Central Exhibit Dimmer	dimmer rack & modules, no installation
Alternate Sustainability	dual blended 10K DLP, 20 gobo & gesture
Canyon Projection Alternate	(3) 8'x10' projections, S-Def

C. Rack has KVM switch to monitor all computer and patchable video monitor for monitoring video playback.

D. Many exhibits have motion sensors covering area in front of exhibit to trigger the start of the show. Selecting, providing, installing and wiring a motion sensor is in this scope.

E. Many exhibits have hidden docent pushbutton switches to start and stop specific exhibits. Providing, installing and wiring a SPST momentary switch is in this scope.

F. projection exhibits may have dual projectors for back-up. There is no intention to run both projectors at the same time so pixel resolution alignment is not required.

1.04 SUBMITTALS

A. Submit the following information as part of the Bid:

1. Qualifications:

a. Contractor **must** have completed three major audiovisual installations with audio, video and control in a museum exhibit environment of similar scope and scale in the last 5 years. Submit descriptions of these installations and references. Submit name and experience of project manager and lead programmer.

2. Equipment Costs: Provide unit prices for each item of equipment. Unit prices will serve as the basis for calculation of the values of substitutions and changes.

3. Summary of Equipment and Non-Equipment Costs: Tabulate cost summaries separately for systems. Break down non-equipment costs according to the following categories:

   a. Equipment

   b. Engineering

   c. Installation of Contractor Supplied Equipment

   d. Show control programming

   e. Interactive programming (if any)

   f. General and Administrative

   g. Taxes

   h. Total

4. Service Contract: Supply a quotation for a one year extension of the warranty on all systems. If the Museum elects to purchase a Service Contract it will be separate from this contract.

5. Schedule of Implementation: Supply an implementation in PERT chart format, which should include the following milestones:

   a. shop drawings complete

   b. Programming chart complete

   c. order equipment

   d. receive equipment

   e. pull cable

   f. deliver equipment to site

   g. site installation complete

   h. consultant checkout

   i. punch list complete

   j. training complete

6. Substitutions: Submit bids using the specified equipment. Proposals for substitute equipment will be considered where superior or more cost effective equipment can be substituted without negatively affecting the performance of the integrated

systems. Such proposals should be justified and be submitted with technical documentation including manufacturer's specifications. .

7. List of Replacement Parts: Supply a list of replacement parts to be provided as part of this contract, subject to the following guidelines:

   a. 1 spare lamp set for each video projector,

B. Supplemental Pricing

1. Within 3 working days after bid opening, apparent low bidder shall submit to the Museum supplemental pricing information for all audiovisual items listed in the Section 2.04 Equipment Schedule.

C. Shop Drawings Prior to Fabrication:

1. Submit shop drawings to include the following:

   a. Functional block diagrams for the audio, video, room control, and network/telecom systems. Label all inputs and outputs.

   b. Rack, frame and backboard elevations for all systems.

   c. Audio, video and network patch panels.

   d. Detailed riser diagram.

   e. Panel details showing all engraving for all systems.

   f. Schematics of all custom circuits.

   g. Detail any modifications to equipment supplied by manufacturers.

   h. Screen images of the audio processor programs showing blocks and all control pages, and a listing of statistics from the compiler showing board, processor and net utilization.

   i. Chart or other documentation of exhibit programming functionality.

      This should document:

      a. How the exhibit operates on the floor

      b. How the exhibit is turned on & off

      c. Any staff controls for test/debug

2. Submit coordination drawings to include the following:

   a. Installation details for equipment or panels mounted in furniture.

D. Engineering: Contract for the services of an appropriately licensed professional engineer where required to complete the work described in these specifications and the associated drawings.

E. On completion of the Installation:

1. Submit written notification to the Museum Representative of completion of initial tests, and coordinate checkout schedule.

2. Submit as-built drawings, to include:

   a. Functional block diagrams for the audio, video, room control, and network/telecom systems. Label all inputs and outputs.

   b. Rack, frame and backboard elevations for all systems.

   c. Audio, video and network patch panels.

   d. Wire lists for all systems, assigning wire numbers for every wire.

   e. Schematics of all custom circuits.

   f. Detail any modifications to equipment.

3. Submit System Operation and Maintenance Manuals as specified in Section 01730, to include:

   a. All manufacturer's manuals.

   b. In a narrative section illustrated as necessary, describe the typical procedures to be followed in configuring and operating the systems. This manual should be written for a technically literate reader who is not an expert.

   c. A programmer's manual, intended to guide an experienced programmer through the custom software, with appropriate references to manufacturer's manuals.

   d. A maintenance manual, describing programmed maintenance procedures with appropriate references to manufacturer's manuals.

   e. A troubleshooting guide.

   f. A summary in tabular form of the operating settings of all adjustable components.

QUALITY ASSURANCE

F. Field Cooperation: Cooperate at all times with all trades doing work on site to minimize lost time, work stoppages and interference.

G. Performance Standards:

H. The following standards shall be met for all audio paths within the facility (not including telephone or WAN connections):

a. Signal to noise ratio (SNR) 65 dB, measured from 40 Hz to 15 kHz.

b. Total harmonic distortion plus noise (THD+N) 1% maximum, measured from 40 Hz to 15 kHz.

c. Audio systems shall be free of noticeable hum and buzz.

2. Audio systems shall be adjusted as follows:

a. Loudspeaker frequency response after equalization: ± 3dB, 100 Hz to 2.5 kHz. Roll off at > 6dB/octave below 100 Hz, and 2 dB/octave above 2.5 kHz, on axis of any loudspeaker.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store all material until it can safely be installed on site. Coordinate delivery times, storage and protection of the equipment at the site, and acceptance with authorized representatives of the Museum.

1.06 WARRANTY

A. Provide a 1 year warranty on the installed systems. Warranty period shall begin on acceptance of the system by the Museum.

B. Warranty shall cover labor and materials required to keep systems functioning as they were at the time of acceptance. Consumables such as projector and document camera lamps are not covered by the warranty. Damage or loss due to improper operation of the equipment, fire, flood, earthquake or theft shall not be covered by the warranty.

C. During the warranty period, inspect the system quarterly and restore all equipment to original performance.

Part-2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new and shall meet or exceed the latest published specifications of the manufacturer in all respects.

B. Supply the latest model of each piece of specified equipment available at the time of bidding. In the event that models are superseded between bidding and ordering of equipment, notify the Museum provide the latest model with equal or superior specifications if the cost does not exceed that of the equipment as bid. If the cost of the

newer piece exceeds the bid amount the Museum may elect to purchase the newer piece as a change order at additional cost.

2.02 SOFTWARE

A. Show control software will be the responsibility of the contractor. Show control software will operate exhibits as described in media briefs. In addition software will provide for:

- Scheduled system on/off following museum operation hours
- Manual override of schedule for events
- Global volume controls
- System status reporting.
- Any Code mandated fire shutdown.

B. Media software will be the responsibility of Media Producer

C. Contractor will be responsible for setting up any computers supplied by contractor so they will autoboot with no login to the operating system.

2.03 CUSTOM FABRICATION

A. Unless otherwise specified, custom plates shall be 1/8" brushed aluminum with beveled edges. Labels shall be engraved and paint filled. Anodized finish and infill colors to be approved by Museum Representative.

B. Adopt either EIA 568-A or –B wiring standard for Cat-5 cable to coordinate with data/telecom contractor.

C. Avoid use of mini-din connectors for S-video on custom plates. Use dual 75 ohm BNC on plate and adapters at equipment.

D. Equipment mounted in racks shall be labeled

E. Seismic safety: Attach all permanently installed equipment to the building to minimize risks to personnel and the equipment in the event of earthquake. Brace all hanging equipment appropriately. Obtain the services of an appropriately licensed engineer for design of attachments and mounts where required by codes or prudent practice.

F. All custom fabricated circuits employing integrated circuits and/or discrete components will be built using custom printed circuit boards. Wire wrap or soldered construction on prototyping boards is not acceptable. Exception: Pads and other simple networks that can be built into connector bodies or barrels.

PART 3 EQUIPMENT SCHEDULE

CANYON

Trail Head *(6) computer interactives + gift shop printer)*

7) 17" Touch Monitors	ELO 1739L
7) Computers	HP/Dell Pentium
6) Cat-5 Extender	TBD/ Magenta
1) Printer (in gift shop)	HP P4014N

Trail System *Software & Server for Smart Phone System*

1) Custom CPU based phone system

This is mostly a programming effort. See media treatments for details.

SKY

Weather Station *Weather display*

1) 46" Monitor	NEC 4620
1) Computers	HP/Dell Pentium
1) Cat-5 Extender	TBD/ Magenta
1) Interface to Instruments	TBD

1) Hardware or software to display split screen of

Live weather instruments
Live sky cam
Feed from UofU Meteorology dept.

Snowflake Video V*ideo playback w/sound, linear media*

1) 22" LCD flat panels	Sharp LC-22SB24U
1/4) 8 channel amplifier	QSC CX-168
2 Speakers	JBL CTRL 25/ TBD
1) Media Players	Pioneer DVD-5000 or Server
a/r Show Controller	MSC / CRESTRON / AMX

NATIVE VOICES

Storytelling *Audio playback w/ 5 soundsticks and 4 Caption readers.*

1) Focused Speaker	Dakota FA-501
1) MP3 playback	4MP3
4) Caption Displays	Densitron LM4790
4) Electronic drivers for above	Custom
1) Docent Switch & Sensor	Custom/TBD
a/r Show Controller	MSC / CRESTRON / AMX

Generational Memory *Videos w/ 5 soundsticks*

1) 46” LCD flat panels	NEC 4620-2-AV
1) Media Players	Pioneer DVD-5000 or server
5) Soundsticks	Stop & Listen “Gorilla”
1) Headphone Amp	Behringer HA-800

Welcome *Triggered audio message*

1) Speakers	JBL Control 25
1) MP3 playback	4MP3
1) Sensor	Passive Infrared / TBD

Language Station *17” monitor, CPU, kbd & trackball*

1) 17” Monitors	ELO 1747L
1) Computers	HP/Dell Pentium
1) trackball	Happ 56-5600-16
1) Cat-5 Extender	TBD/ Magenta
1) Headphone Amp	Berringer

LIFE

Keritan Interactive ~24 2" 2 digit readouts, electronics package & programming to run game

48)	2" 5x7 Led Dot Array Verify color with designer	LiteON LTP-2157AY
24)	Custom circuit cards for above including Drivers and controller (note this must be PCB)	
1)	Central controller/computer to run game.	
1)	Programming to provide complete functional interactive Per media brief.	

What Cells Can Do *~4'x'6' projected image linear media w/ sound*

1)	5K lumen Projector	Eiki EIP-5000
1)	Media Players	Pioneer DVD-5000 or server
1)	Directional Speaker	Dakota FA-501
a/r	Show Controller	MSC / CRESTRON / AMX

Ecosystems *(4) areas of natural sounds*

Equipment list is for all 4 dioramas combined

2)	4 track MP3 player w/ dsp mixer	MSC-4MP3
16)	Small speakers	JBL Control 25
2)	8 channel amplifier	QSC CX-168

Human Interactions *(4) audio players with mushroom handsets*

1)	4 track MP3 player w/ dsp mixer	MSC
4)	Small handsets (mushroom shaped)	TBD custom
1)	multi channel headphone amplifier	Behringer HA-8000
4)	Capacitive sensors/ buttons	Custom / Happ

Talkback Station (*typ of 3) computer blogging stations.*

1)	12" Monitors (touch optional)	ELO 1247
1)	Computers	HP/Dell Pentium
1	Keyboard/trackball	TBD
1)	Cat-5 Extender	TBD/ Magenta

THE LAND

Plate Tectonics Video *Globe*

32” Video Globe	Omni Globe
a/r Show Controller	MSC / CRESTRON / AMX

Human Interactions *(3) audio players with mushroom handsets*

1) 4 track MP3 player w/ dsp mixer	MSC-4MP3
3) Small handsets (mushroom shaped)	TBD custom
1) multi channel headphone amplifier	Behringer HA-8000
3) Capacitive sensors/ buttons	Happ / Custom

Talkback Station *computer blogging station.*

See description in Life above

B&R Biogeography *46” SD video playback*

1) 26” LCD flat panels	Sharp LC26SB24U
1) Media Players	Pioneer DVD-5000 or server
a/r Show Controller	MSC / CRESTRON / AMX

Earthquake Monitor *15” Monitor, CPU, network data feed*

1) 15” Monitors	NEC ALSCD52V-BK
1) Computers	HP/Dell Pentium
1) Cat-5 Extender	TBD/ Magenta

Jump Seismometer 24” Monitor. Exhibit OFE

1) 24” monitor	Sharp LC26SB24U/TBD

Depending on exhibit feed

FIRST PEOPLES

Ceramics, Tools & Weaving *(3) 20" video playback w/ sound, linear media*

3) 22" LCD flat panels	Sharp LC-22SB24U
3)Media Players	Pioneer DVD-5000 or Server
a/r Show Controller	MSC / CRESTRON / AMX

LAKE

Sounds of the Lake *(8) speaker natural sound soundscape*

1) 4 track MP3 player w/ dsp mixer	MSC-4MP3
8) small speakers	JBL Control 25
1) 8 channel amplifier	QSC CX-168

Watershed *46" video playback w/ sound, SD linear media*

1) 46" LCD flat panels	NEC LCD 4620-2-AV
2) Speaker	TBD
1) Media Players	Pioneer DVD-5000 or Firefly
a/r Show Controller	MSC / CRESTRON / AMX

People and the Lake *46" video playback w/ sound, SD linear media*

1) 46" LCD flat panels	NEC LCD 4620-2-AV
2) Speaker	TBD
1) Media Players	Pioneer DVD-5000 or Firefly
a/r Show Controller	MSC / CRESTRON / AMX

PAST WORLD

Paleo Prep *video playback w/ sound, SD linear media*

1) 20” LCD flat panels	Sharp LC-20 (integral speakers)
1) Media Players	Pioneer DVD-5000 or Server
a/r Show Controller	MSC / CRESTRON / AMX

Cleveland Lloyd Quarry Quad *video playback w/sound, linear media*

4) 20” LCD flat panels	Sharp LC-22SB24U
4) Media Players	Pioneer DVD-5000 or Server
1/4) 8 channel amplifier	QSC CX-168
2 Speakers	JBL CTRL 25/ TBD
a/r Show Controller	MSC / CRESTRON / AMX

Late Cretaceous Soundscape *(6) speaker natural sound soundscape*

1) 4 track MP3 player w/ dsp mixer	MSC-4MP3
6) small speakers	JBL Control 25
1) 8 channel amplifier	QSC CX-168

Utah Future

Sustainability Interactive Diorama Projections & interactive

1) 10K Lumen LCD	Eiki XT-4
1) lens	Eiki TBD
1) set spare lamps	
1) CPU	HP/Dell
1) Graphics Card	TBD
1) Cat-5 Extender	TBD/ Magenta
15) Gobo projectors	ETC Source 4
30) Custom gobos	Apollo
1) Dimming interface	MSC/AMX/Crestron
15) Capacitive Sensors	Custom
a/r Show Control	MSC/AMX/Crestron

Talkback Station *Audio playback/recording station*

1) 12” Monitors (touch optional)	ELO 1247
1) Computers	HP/Dell Pentium
1) Keyboard/trackball	TBD
1) Cat-5 Extender	TBD/ Magenta
1) Small speakers	TBD
1) Microphone & shock mount	AKG C2000B/H100
1) Mic stand/boom arm	AKG/Custom
1) Microphone processor	Symetrix 528E

<u>Our Backyard</u>

Our Backyard Animal Sounds (5) *speaker soundscape*

1.5) 4 track MP3 player w/ dsp mixer	MSC-4MP3
5) Speakers	3-4” Custom TBD
1) multi channel amplifier	QSC 168

Central Dimmer

ETC Sensor Rack 48 dual dimmer modules

Our budget only includes providing the dimmer. The installation and wiring of this unit would be part of the base building electrical package.

Add Options

If budget allows the following additions can be considered.

Upgrade Sustainability (Dual blended projection)

2) 10K lu DLP Projector	Panasonic PT-DW10000U
2) Warping Video Server	7th Sense
2) Lens	TBD
2) sets spare lamps	
2) Fiber Optic extenders	Purelink OHD
20) Gobo projectors	ETC Source 4
40) Custom gobos	Apollo
1) Dimming interface	MSC/AMX/Crestron
2) Video Camera w/ lens	TBD
1) Gesture system CPU	Custom
a/r IR illuminators	Custom
a/r Show Control	MSC/AMX/Crestron

Software to run gesture system per media spec

Canyon Projections (3) ~8x10 projections on canyon walls

3) 10K Lumen LCD	Eiki XT-4
3) lens	Eiki TBD
3) set spare lamps	
3) Media Players	Pioneer DVD-5000 or Firefly
3) Cat-5 Extender	TBD/ Magenta
a/r Show Control	MSC/AMX/Crestron

Central Media Playback to Learning Labs

(3) Media Player	Pioneer DVD-5000 or server

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to commencing installation, verify all critical dimensions and conditions under which work is to be installed. Notify Museum Representative in writing of any dimensional discrepancies or other conditions detrimental to the proper installation or performance of work. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Insure that no devices (including cameras, monitors, projectors, microphones and loudspeakers) are prevented from achieving their intended function by interfering fixtures, architectural elements, or other audiovisual equipment. Notify Museum Representative in writing of any such problems, and do not proceed with installation until unsatisfactory conditions have been corrected.

C. Contractor is responsible for assuring that no CAT5 cable runs provided by the Contractor exceed 90m. Notify Museum Representative in writing of any runs that will exceed this distance.

D. Carefully verify all required projection and camera lens focal lengths to achieve desired image sizes. Notify Museum Representative in writing if no lens will fit the requirements. Note this means no lens, not just the standard lens that comes with the projector.

3.02 INSTALLATION

A. General

1. All cables, regardless of length, will be marked with permanent, non-handwritten number or letter cable markers within six inches of both ends. There shall be no unmarked cables at any place in the system. Marking codes used on cables shall correspond to codes shown on drawings and/or run sheets.

2. All cables shall be installed splice free from backboard, rack or frame to final destination.

3. Each of the cable groups identified in the project drawings are to be run in separate conduit, bundled separately where run in trays, and grouped within racks except where specifically noted.

4. Wherever possible, maintain 3” separation between cable groups. Maintain larger separations where necessary to avoid interference.

5. All cable shall carry at least the NEC CM rating. Use plenum cable everywhere in project other than within racks or in runs completely within conduit.

6. Provide sufficient ventilation within racks to insure that all equipment operates within manufacturer’s recommendations.

7. All boxes and equipment shall be mounted plumb and square.

B. Audio

1. Maintain phasing throughout the audio system.

2. Use crimp type lugs where stranded wire is connected to barrier strips and binding posts.

3. AV equipment racks shall be installed on a 1/8" Lexan sheet with isolating washers. Each rack shall contain a grounding bus bonded to the rack frame and connected to the audiovisual power distribution panel with a #6 or larger conductor. The rack shall show an impedance of at least 100 Kohm to ground when this conductor is lifted.

4. AC outlets within racks shall have ground wires, which shall be connected to the rack ground bus.

5. Connect audio cable shields at one end or both ends to produce best system noise performance. Mic lines and tie lines shall have shields connected at both ends.

C. Video

1. All coaxial cable connections shall be made with crimp type BNC connectors. Provide adapters from BNC to UHF, S-Video or RCA connectors where required.

2. All video receptacles shall be insulated from the panels in which they are installed.

3. Terminate all unused outputs with the appropriate impedance.

4. Video signals may not be looped through connections unless explicitly specified.

5. The lengths of the cables used to carry S-video and component video signals shall be matched to within 1".

6. Projectors and cameras shall be installed so that images do not move or vibrate perceptibly under normal operating conditions.

3.03 FIELD QUALITY CONTROL

A. In all cases, provide written documentation of tests including date, test equipment used, test equipment configuration and results.

B. Initial Tests and Measurements:

1. Verify the operation of all system equipment.

2. Verify pinout and pairing of all wiring.

3. Verify DCE/DTE (pin 2/3) requirments of all serial cables. Test to verify voltage on both pins. Wire cable as x-over (null modem) if required.

C. Audio-Visual Systems:

1. Verify that audio systems are free from perceptible hum and buzz.

2. Conduct measurements and adjust audio systems to meet performance standards.

3. Measure impedance of all loudspeaker circuits at 1 kHz and verify that transformer tapping is appropriate.

4. Test that all coaxial cables are free from shorts and isolated from ground.

5. Verify that video systems do not exhibit interference effects from AC power circuits (video hum).

6. Align all video projectors and adjust color balance on projectors and monitors.

3.04 MUSEUM TRAINING

A. Provide 20 hours of training to persons designated by the Museum in the operation of the systems in 5 non-contiguous 4-hour sessions.

3.05 FINAL ADJUSTING AND ACCEPTANCE TESTS

A. Inventory all equipment on site and compare to equipment lists in contract documents.

B. Demonstrate operation of all systems and equipment.

C. Review initial testing measurements. Repair system and repeat measurements as required by the Museum Representative.Provide the following test equipment for use in making adjustments and acceptance testing by the Museum Representative:

1. Composite, S video color bar generator.

2. 1/3 octave real time analyzer, calibrated SPL meter, and RMS voltmeter capable of reading in dBu.

3. Audio tone generator and pink noise generator.

4. Audio impedance meter operating at 1 kHz.

5. Audio analyzer capable of measuring frequency response: MLSSA 9.0, TEF 20 or SIA SMAART.

6. Cat 5 tester

7. Video Test Generator both SD & HD

D. Provide personnel expert in the operation and programming of all installed equipment for up to 80 straight time hours and 10 overtime hours to assist owner and consultant for adjustment and acceptance testing.

E. Tests may be suspended at the option of the Museum Representative if the systems fail to operate or if defective equipment requires repair or replacement. Tests will be resumed when the problems have been corrected by the Contractor.

3.06 CLEANUP AND REPAIR

A. The job site should be left clean and any damage caused to premises by installers should be repaired at no cost to Museum.

3.07 PROTECTION OF WORK

A. It is the responsibility of the contractor to protect finished and unfinished work against damage or loss until the date of final acceptance. Contractor shall take measures to prevent damage by dust and other byproducts of construction. Repair damaged work at no cost to the Museum.

B. Museums are full of artifacts and other irreplaceable objects. While most of your work will take place prior to the installation of artifacts there will be some overlap. It is imperative that you take extra care to avoid risks to these objects. If you are unsure ask the museum staff for assistance.
Also many of these items have deep cultural value and no jokes or disrespectful comments will be tolerated.

END OF SECTION

VA2026w

20" VALUE SERIES WIDESCREEN LCD

WITH 5MS VIDEO RESPONSE

Big, wide, budget-friendly.

ViewSonic's 20" VA2026w LCD brings value to big, widescreen displays. This display doesn't compromise on features with versatile OptiSync® digital and analog inputs and super-high 1680x1050 resolution for brilliant HD images. This stylish 20-inch LCD delivers EXTREME CLARITY, AMAZING COLOR with 2000:1 DYNAMIC CONTRAST RATIO (typ) and fast ClearMotiv® 5ms video response. Enjoy beautiful graphics and view spreadsheets in unbelievable clarity. Enjoy greater productivity with the ability to VIEW TWO FULL-SIZE DOCUMENTS SIDE-BY-SIDE or work in multiple applications simultaneously on the widescreen display. The stylish, slim-bezel design and VESA® wall-mount compliance allow the VA2026w to fit seamlessly into any office décor. It's great for desktop applications at home, school or in the office.

2000:1 Dynamic Contrast Ratio

A WIDESCREEN DISPLAY FOR ANYONE

- **Fast 5ms video response delivers superior picture clarity**
- **Full 20" viewable widescreen**
  Displays a full, flat 20" viewable area with crisp detail and fully saturated color.
- **1680x1050 native resolution**
  Incredible image detail for sharp text and graphics.
- **2000:1 dynamic contrast ratio (typ)**
  Provides for darker black levels and better overall front-of-screen performance.
- **Stylish slim-bezel design**
  An ultra-thin bezel lets you see more without taking up valuable desktop real estate.
- **OptiSync® digital/analog inputs expand your connectivity**
  Multi-mode input technology supports both digital (DVI) and analog (VGA) signals for ultimate compatibility and configuration flexibility.
- **OSD/power lock secures your settings**
  Prevents changes to monitor settings and maintains an optimized image.
- **OnView® controls for superior screen adjustability**
  Screen adjustments are precisely made via an easy-to-use on-screen menu.
- **Windows Vista approved**
- **ViewSonic Wizard included**
  User-friendly Wizard software automates the setup process to deliver optimized screen performance.
- **PC and Mac® compatible**
- **TCO'03 and ENERGY STAR® qualified**

MORE THAN 2000 AWARDS

VIEWSONIC
PRODUCTS, PROGRAMS, AND SERVICES

ViewSonic®
See the difference®

VA2026w

20" VALUE SERIES WIDESCREEN LCD WITH 5MS VIDEO RESPONSE

LCD	Type	20" color TFT active matrix WSXGA LCD
	Display Area	17.1" horizontal x 10.7" vertical; 20.1" diagonal
	Optimum Resolution	1680x1050
	Contrast Ratio	1000:1 static (typ), 2000:1 dynamic (typ)
	Viewing Angles	170° horizontal, 160° vertical
	Response Time	5ms (typ)
	Light Source	Long life, 40,000 hrs. (typ)
	Brightness	300 cd/m2 (typ)
	Panel Surface	Anti-glare
VIDEO INPUT	Analog/Digital	RGB analog (75 ohms, 0.7 Vp-p)/DVI-D (HDCP)
	Frequency	F_h: 30~82kHz, F_v: 50~75Hz
	Sync	H/V separated (TTL)
COMPATIBILITY	PC	VGA up to 1680x1050 non-interlaced
	Mac®*	Power Mac™ G3/G4/G5 up to 1680x1050
CONNECTOR	Analog/Digital	15-pin mini D-sub/DVI-D
	Power	3-pin AC plug (CEE22)
POWER	Voltage	AC 100–240V (universal), 50/60Hz (auto switch)
	Consumption	38W (typ)
CONTROLS	Basic	Power, 1, down, up, 2
	OnView®	Auto image adjust, contrast, brightness, input select, ViewMatch® color adjust (sRGB, 9300K, 6500K – default, 5400K, RGB), information, manual image adjust (H. size, H. position, V. position, fine tune, sharpness), setup menu (language, resolution notice, OSD position, OSD timeout, OSD background), memory recall
ERGONOMICS	Tilt	-5°/+20°
OPERATING CONDITIONS	Temperature	32–104°F (0–40°C)
	Humidity	20–90% (non-condensing)
DIMENSIONS (W x H x D)	Physical with stand	18.6" x 16.1" x 8.9" (472mm x 408mm x 225mm)
	Physical without stand	18.6" x 12.9" x 2.5" (472mm x 327mm x 65mm)
WEIGHT	Net with stand	10.8 lb. (4.9 kg)
	Net without stand	9.5 lb. (4.3 kg)
	Gross with stand	14.1 lb. (6.4 kg)
REGULATIONS		UL, cUL, FCC-B, CB, CE, NOM, TUV-S, TUV/GS, TUV/ERGO (covers ISO13406-2), MPR II, BSMI, CCC, ENERGY STAR,® PSB, C-TICK, RoHS, WEEE, VCCI, GOST-R, SASO, TCO'03, EPEAT-Silver
RECYCLE/DISPOSAL		The lamp in this product contains mercury. Please dispose of in accordance with local, state and federal laws.
POWER MANAGEMENT		Meets TCO'03 and ENERGY STAR® standards
PACKAGE CONTENTS		LCD display, video cable, power cable, Quick Start Guide, ViewSonic Wizard (DVI cable not included)
WARRANTY		Three-year limited warranty on parts, labor and backlight

CERTIFIED FOR Windows Vista™

TCO Development TCO'03 DISPLAYS www.tcodevelopment.com

RoHS COMPLIANT™

BSI REGISTERED ISO 9001:2000 FM 40187

BSI REGISTERED ISO 14001:1996 FM 40968

ViewSonic Corporation's QMS & EMS have been registered to ISO 9001 & ISO 14001, respectively, by the British Standards Institution.

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*Adapter may be required. Analog adapter available from ViewSonic. Specifications subject to change without notice. Selection, offers and programs may vary by country; see your ViewSonic representative for complete details. Windows Vista and the Windows logo are trademarks or registered trademarks of Microsoft Corporation in the United States and/or other countries. Corporate names, trademarks stated herein are the property of their respective companies. Copyright © 2007 ViewSonic Corporation. All rights reserved. [13624-00B-08/07] VA2026w-1

For more product information, visit us on the web at ViewSonic.com

FEATURES

∗2.0 inch (50.8 mm) MATRIX HEIGHT.
∗LOW POWER REQUIREMENT.
∗SINGLE PLANE, WIDE VIEWING ANGLE.
∗SOLID STATE RELIABILITY.
∗5×7 ARRAY WITH X-Y SELECT.
∗COMPATIBLE WITH USASCII AND EBCDIC CODES.
∗STACKABLE HORIZONTALLY.
∗CATEGORIZED FOR LUMINOUS INTENSITY.

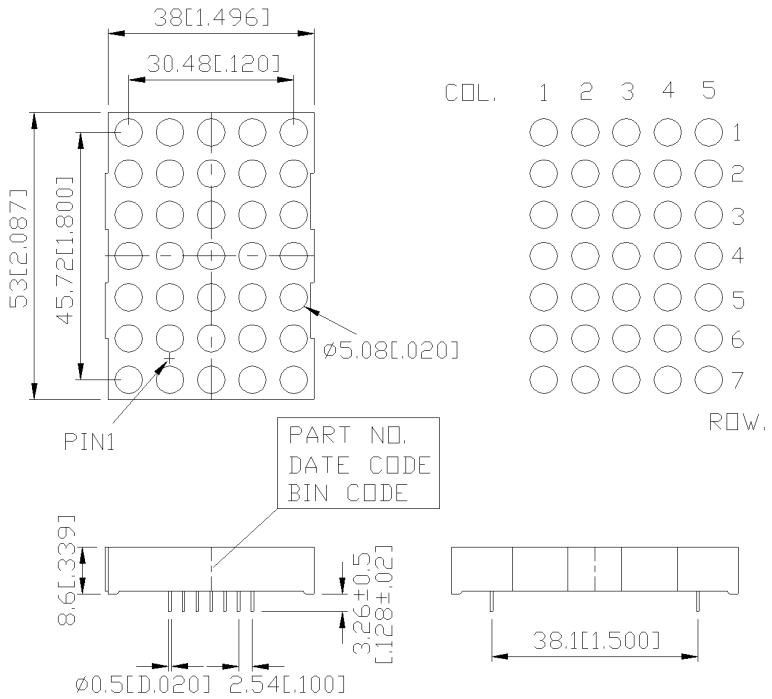
DESCRIPTION

The LTP-2157AY is a 2.0 inch (50.8 mm) matrix height 5×7 dot matrix display. This device utilizes yellow LED chips, which are made from GaAsP on a transparent GaP substrate, and has a gray face and white dot color.

DEVICE

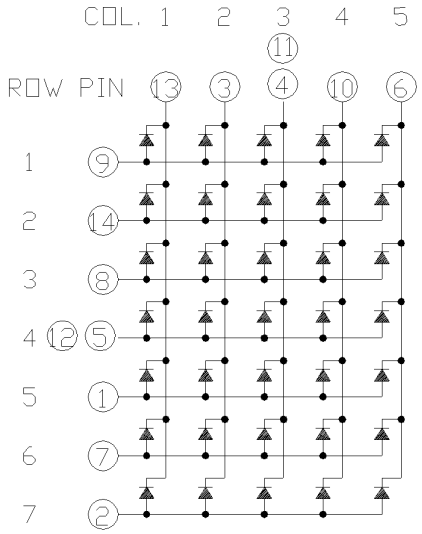
PART NO.	DESCRIPTION
YELLOW	CATHODE COLUMN
LTP-2157AY	ANODE ROW

PACKAGE DIMENSIONS



NOTES: All dimensions are in millimeters. Tolerance is ± 0.25 mm (0.01“) unless otherwise noted.

INTERNAL CIRCUIT DIAGRAM



PIN CONNECTION

No.	CONNECTION
1	ANODE ROW 5
2	ANODE ROW 7
3	CATHODE COLUMN 2
4	CATHODE COLUMN 3*1
5	ANODE ROW 4*2
6	CATHODE COLUMN 5
7	ANODE ROW 6
8	ANODE ROW 3
9	ANODE ROW 1
10	CATHODE COLUMN 4
11	CATHODE COLUMN 3*1
12	ANODE ROW 4*2
13	CATHODE COLUMN 1
14	ANODE ROW 2

NOTES : 1. Pin 4 & 11 are internally connected.
2. Pin 5 & 12 are internally connected.

ABSOLUTE MAXIMUM RATING AT Ta=25°C

PARAMETER	MAXIMUM RATING	UNIT
Average Power Dissipation Per Dot	32	mW
Peak Forward Current Per Dot	80	mA
Average Forward Current Per Dot Derating Linear From 25℃ Per Dot	10 0.12	mA mA/℃
Reverse Voltage Per Dot	5	V
Operating Temperature Range	-35℃ to +85℃	
Storage Temperature Range	-35℃ to +85℃	
Solder Temperature: max 260℃ for max 3sec at 1.6mm[1/16inch] below seating plane.		

ELECTRICAL / OPTICAL CHARACTERISTICS AT Ta=25°C

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Average Luminous Intensity	I_V	1780	4800		μcd	I_P=80mA 1/16Duty
Peak Emission Wavelength	λp		585		nm	I_F=20mA
Spectral Line Half-Width	Δλ		35		nm	I_F=20mA
Dominant Wavelength	λd		588		nm	I_F=20mA
Forward Voltage any Dot	V_F		2.1	2.6	V	I_F=20mA
			3.0	3.7		I_F=80mA
Reverse Current any Dot	I_R			100	μA	V_R=5V
Luminous Intensity Matching Ratio	I_V-m			2:1		I_F=10mA

Note: Luminous intensity is measured with a light sensor and filter combination that approximates the CIE (Commision Internationale De L'Eclairage) eye-response curve.

TYPICAL ELECTRICAL / OPTICAL CHARACTERISTIC CURVES

(25°C Ambient Temperature Unless Otherwise Noted)

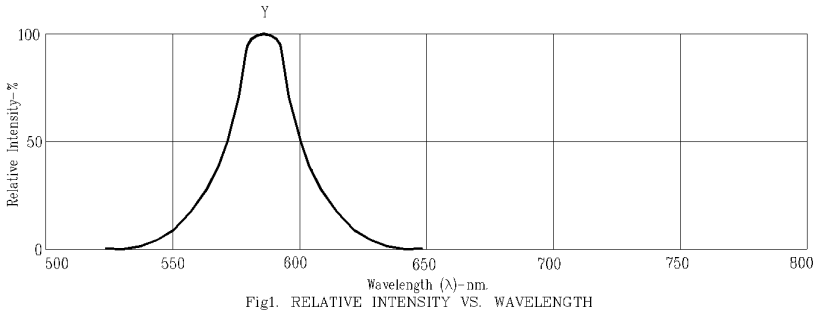


Fig1. RELATIVE INTENSITY VS. WAVELENGTH

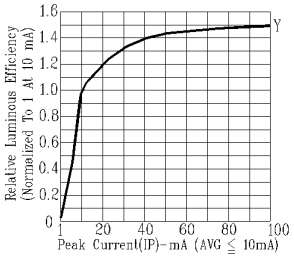


Fig2. RELATIVE LUMINOUS EFFICIENCY (LUMINOUS INTENSITY PER UNIT CURRENT) VS. PEAK CURRENT (REFRESH RATE 1KHz)

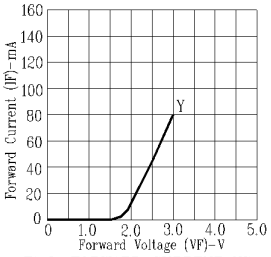


Fig3. FORWARD CURRENT VS. FORWARD VOLTAGE

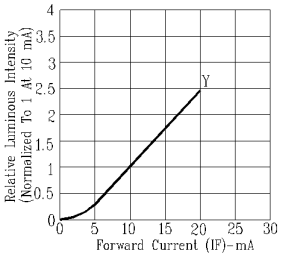


Fig4. RELATIVE LUMINOUS INTENSITY VS. FORWARD CURRENT

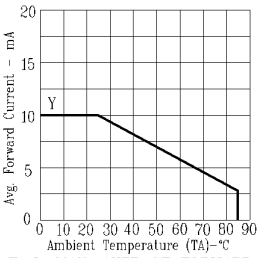


Fig8. MAX. AVERAGE FORWARD CURRENT VS. AMBIENT TEMPERATURE.

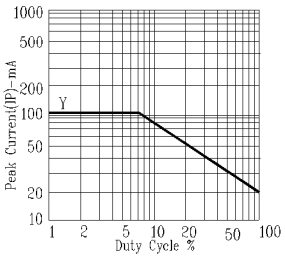
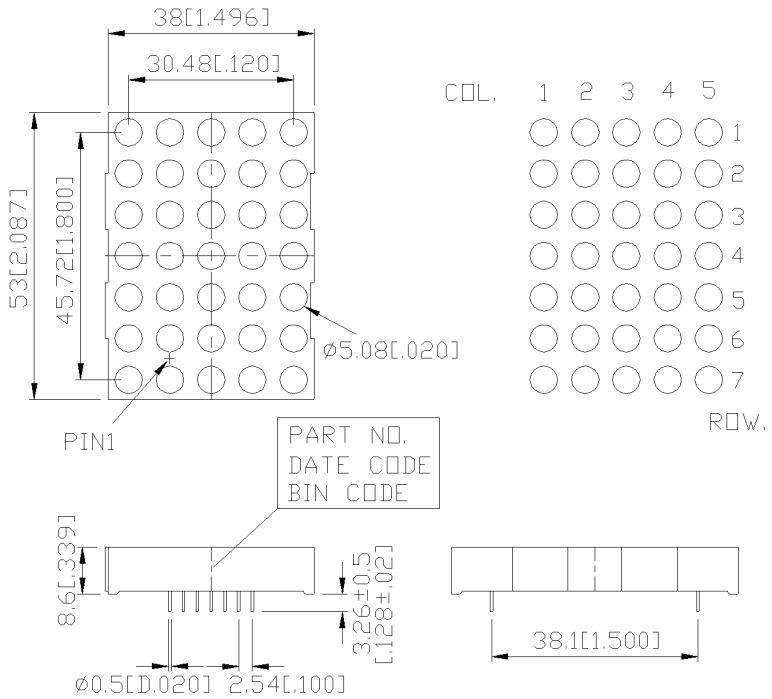


Fig6. MAX. PEAK CURRENT VS. DUTY CYCLE % (REFRESH RATE 1KHz)

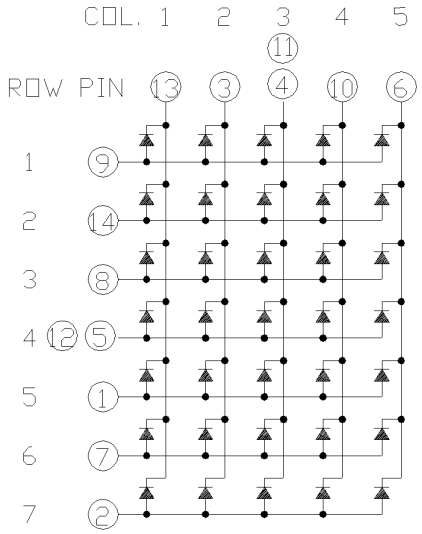
NOTE : Y= YELLOW

PACKAGE DIMENSIONS



NOTES: All dimensions are in millimeters. Tolerance is ± 0.25 mm (0.01“) unless otherwise noted.

INTERNAL CIRCUIT DIAGRAM



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12	ANODE ROW 4*2
13	CATHODE COLUMN 1
14	ANODE ROW 2

NOTES : 1. Pin 4 & 11 are internally connected.
2. Pin 5 & 12 are internally connected.

Clarion

Projection perfection.

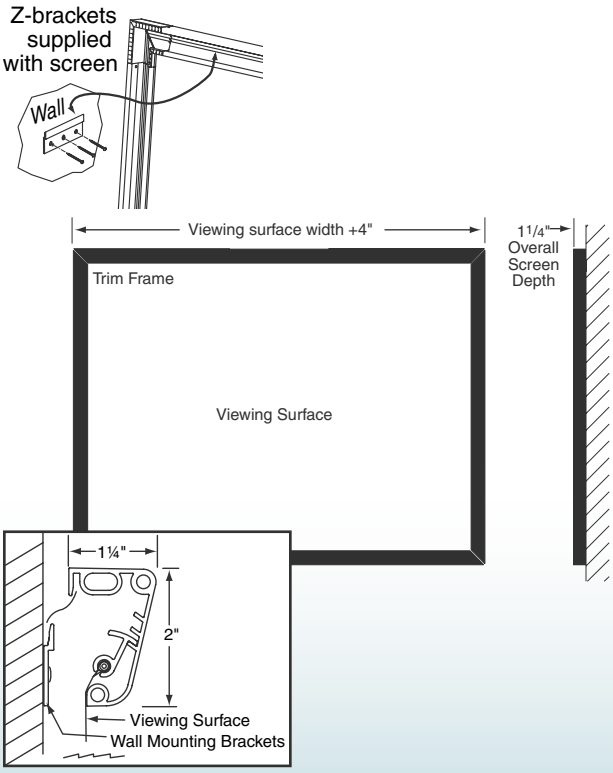
Improve your image—with a Clarion projection screen. How? The viewing surface is perfectly flat. And a perfectly flat viewing surface means perfect picture quality. We've redesigned the Clarion to simplify installation. The Clarion's self-concealing aluminum frame now forms an attractive 2″ border, for a clean, theatre-like appearance. The 2″ wide beveled, extruded aluminum frame interconnects on site with one simple hand tool that Draper provides. Permanent wall mounting brackets included.

Center for Advanced Vehicular Systems (CAVS), Canton (MS) Extension, Mississippi State University. Dealer: Integrated Systems Group–Southern Region, Atlantic Video Corporation, Mobile, AL. Photography: © Jim Bramblett Productions, Mobile, AL. U.S. Patent No. 6,785,047. Other patents pending.

System Options

- ***Viewing Surfaces***—M1300, M2500, HiDef Grey, AT1200 or AT Grey.
- ***Custom Sizes***—Any size up to the maximum standard size in the Clarion chart. Overall size, including frame, equals image area plus 4″.
- ***Frame Finishes***—Black aluminum is standard. Cover the frame with optional velvety black, Vel-Tex to eliminate reflections.

Dimensions/Method of Installation



Dimensions & Data—Clarion

	Image Area H x W	Overall Size H x W	Net Wt. (lbs.)	M1300	M2500	HiDef Grey	AT1200/AT Grey
AV Format	50″ x 50″	54″ x 54″	31	■	■	■	
	60″ x 60″	64″ x 64″	38	■	■	■	
	70″ x 70″	74″ x 74″	39	■	■	■	
	84″ x 84″	88″ x 88″	55	■	■	■	■
	96″ x 96″	100″ x 100″	63	■	■	■	
	9′ x 9′	112″ x 112″	71	■	■	■	
	10′ x 10′	124″ x 124″	79	■	■		
Nominal Diagonal	**Image Area H x W**	**Overall Size H x W**	**Net Wt. (lbs.)**				
NTSC Format (4:3)							
6′	43″ x 57″	47″ x 61″	32	■	■	■	
6½′	47″ x 63″	51″ x 67″	37	■	■	■	
7′	50″ x 67″	54″ x 71″	38	■	■	■	
7½′	54″ x 72″	58″ x 76″	42	■	■	■	
100″	60″ x 80″	64″ x 84″	45	■	■	■	■
10′	72″ x 96″	76″ x 100″	55	■	■	■	■
150″	90″ x 120″	94″ x 124″	72	■	■	■	
15′	108″ x 144″	112″ x 148″	80	■	■	■	
HDTV Format (16:9)							
65″	31¾″ x 56½″	35¾″ x 60½″	31	■	■	■	
73″	36″ x 64″	40″ x 68″	33	■	■	■	
82″	40½″ x 72″	44½″ x 76″	40	■	■	■	
92″	45″ x 80″	49″ x 84″	41	■	■	■	■
106″	52″ x 92″	56″ x 96″	46	■	■	■	■
119″	58″ x 104″	62″ x 108″	54	■	■	■	■
133″	65″ x 116″	69½″ x 120″	59	■	■	■	■
161″	79″ x 140″	83″ x 144″	73	■	■	■	■

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REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	E0200		

1. **Specification subject to change without notice.**
2. **All dimensions and specifications apply to standard modules. This information may vary for modules with optional features.**
3. **All dimensions are in millimeters.**
4. **Precautions:These precautions apply equally to modules from all makers, not just Densitron. Violation of these guidelines may void the warranty and can cause problems ranging from erratic operation to catastrophic display failure.**

Handling precautions:

- This device is susceptible to Electro-Static Discharge (ESD) damage. Observe Anti-Static precautions.

Power supply precautions:

- Identify and, at all times, observe absolute maximum ratings for both logic and LC drivers. Note that there is some variance between models.
- Prevent the application of reverse polarity to V_{DD} and V_{SS}, however briefly.
- Use a clean power source free from transients. Power up conditions are occasionally “jolting” and may exceed the maximum ratings of the module.
- The +5V power of the module should also supply the power to all devices which may access the display. Don’t allow the data bus to be driven when the logic supply to the module is turned off.
- DO NOT install a capacitor between the V_O (contrast) pin and ground. V_{DD} must, at all times, exceed the V_O voltage level. The capacitor combines with the contrast potentiometer to form an R-C network which “holds-up” V_O, at power-down, possibly damaging the module.

Operating precautions:

- DO NOT plug or unplug the module when the system is powered up.
- Minimize the cable length between the module and host MPU. (Recommended max. length 30 cm).
- For models with EL backlights, do not disable the backlight by interrupting the HV line. Unloaded inverters produce voltage extremes which may arc within a cable or at the display.
- Operate the module within the limits of the modules temperature specifications.

Mechanical / Environmental precautions:

- Improper soldering is the major cause of module difficulty. Use of flux cleaner is not recommended as they may seep under the elastomeric connection and cause display failure. Densitron recommends the use of Kester “245” no-clean solder.
- Mount the module so that it is free from torque and mechanical stress.
- Surface of LCD panel should not be touched or scratched. The display front surface is an easily scratched, plastic polarizer. Avoid contact and clean only when necessary with soft, absorbent cotton dampened with petroleum benzene.
- ALWAYS employ anti-static procedure while handling the module.
- Prevent moisture build-up upon the module and observe the environmental constraints for storage temperature and humidity.
- DO NOT store in direct sunlight.
- If leakage of the liquid crystal material should occur, avoid contact with this material, particularly ingestion. If the body or clothing becomes contaminated by the liquid crystal material, wash thoroughly with water and soap.

Notes: (unless otherwise specified)

Unless otherwise specified: Dimensions are mm Tolerances are: X = ± 3, .X = ± 0.5, .XX = ± 0.05	APPROVALS	DATE	DENSITRON CORPORATION TORRANCE, CA	
	DRAWN			
	CHECKED		TITLE 4 LINE X 40 CHARACTERS LCD MODULE	
	ISSUED		DWG. NO. LM4790	SHEET 1 OF 8

1.0 DESCRIPTION

Dot matrix display module consisting of a Liquid Crystal Display, CMOS driver and controller LSI, printed circuit board, metal support frame and array type Light Emitting Diode (LED) backlight.

Available LC fluids types are: NTN (supertwisted nematic), NTN-H (extended temperature range NTN).

Options include on-board negative voltage generation.

2.0 MECHANICAL CHARACTERISTICS

Item	Specifications	Unit
Package Dimensions	280.0 (W) x 88.0 (H) x 11.3 max. (D)	mm
Display format	4 line x 40 characters	-
Character font format	5 (W) x 7 (H) with attached cursor	dots
Driving method	1/16	duty
Dot size	1.0 (W) x 1.77 (H)	mm
Dot pitch	1.05 (W) x 1.82 (H)	mm
Character Size	5.2 (W) x 14.51 (H)	mm
Active display area	239.2 (W) x 63.65 (H)	mm
Viewing area	244.0 (W) x 68.0 (H)	mm
Weight		g

Notes:W-Width;H-Height;D-Depth.

3.0 ABSOLUTE MAXIMUM RATINGS

V_{SS}=0V;T_a=25°C

Item	Symbol	TN, NTN		TN-H, NTN-H		Unit
		Min.	Max.	Min.	Max.	
Logic supply voltage	V_{DD}-V_{SS}	0	7	0	7	V
LC driver supply voltage	V_{DD}-V_O	0	6	0	13	V
Operating temperature Storage temperature (Note 1)	T_{OP} T_{ST}	0 -20	+50 +70	-20 -30	+70 (Note 3) +80	°C
Humidity: Operating (@40°C) Non-operating (@40°C)	- -	- -	85% 95%	- -	85% 95%	RH (Note 2) RH (Note 2)

Notes: 1: Tested to 100 hrs.
2: Refers to non-condensing conditions.
3. With backlight off.

4.0 ELECTRICAL CHARACTERISTICS

V_{DD}=5±0.25V;T_a=25°C

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input “High” voltage	V_{IH}	-	2.2	-	V_{DD}	V
Input “Low” voltage	V_{IL}	-	-	-	0.6	V
Output “High” voltage	V_{OH}	I_{OH}=0.205mA	2.4	-	-	V
Output “Low” voltage	V_{OL}	I_{OL}=1.2mA	-	-	0.4	V
Power supply current	I_{DD}	V_{DD}=5.0V	-	5	-	mA

5.0 RECOMMENDED LC DRIVE VOLTAGE (V_{DD}-V_O)

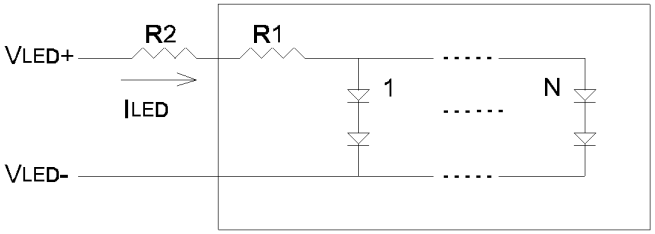
V_{DD}=5.0±0.25V

Temperature	TN	TN-H	NTN	NTN-H
T_a= -20°C	-	-	-	8.3
T_a= 0°C	-	-	5.3	8.1
T_a= 25°C	-	-	4.9	8.0
T_a= 50°C	-	-	4.8	7.9
T_a=70°C	-	-	-	7.8

6.0 BACKLIGHT SPECIFICATIONS:

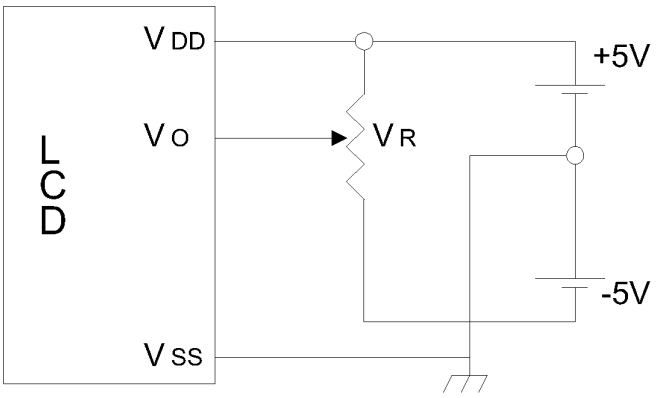
T_a=20°C,60%RH,Darkroom.

Item	Symbol	Typ.	Max.	Unit
LED input voltage	V_{LED}	5	6	V
LED input current	I_{LED}	2200	2300	mA
Built-in current limiting resistor	R1	-	-	Ohms, W
External current limiting resistor (recommended)	R2	0.47 Ohm, 4 W	-	Ohms, W
Number of nodes	N	220	-	-

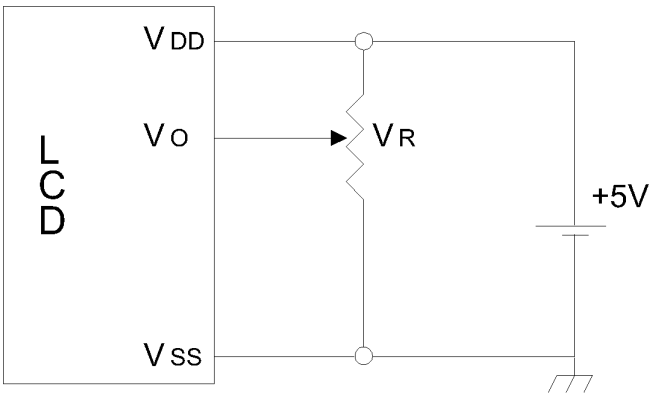


7.0 POWER SUPPLY

TN-H, NTN-H



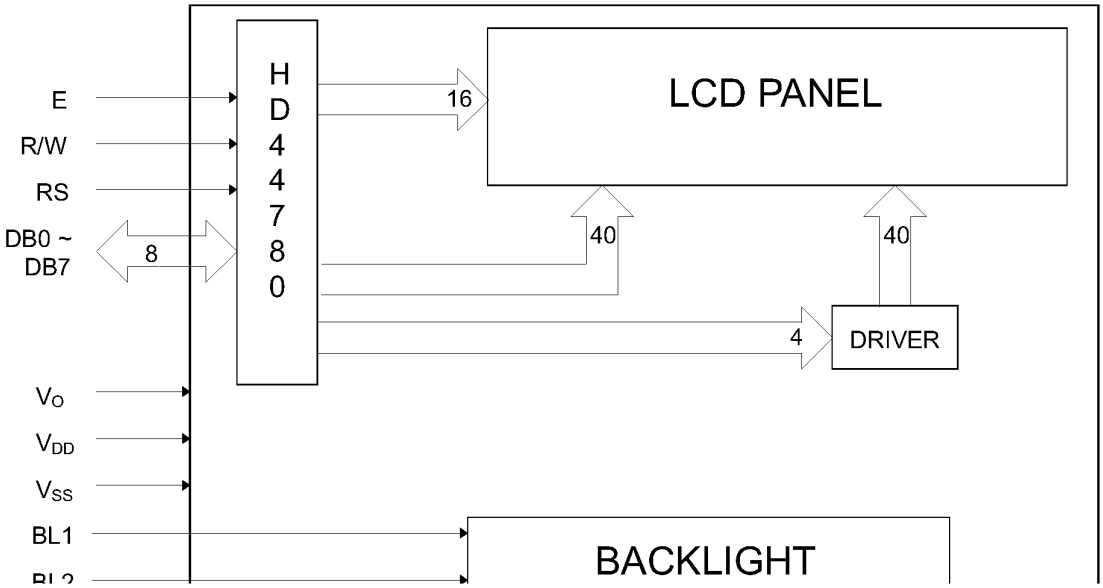
TN, NTN



V_R = 10K - 20K ohm

8.0 INTERFACE DESCRIPTION

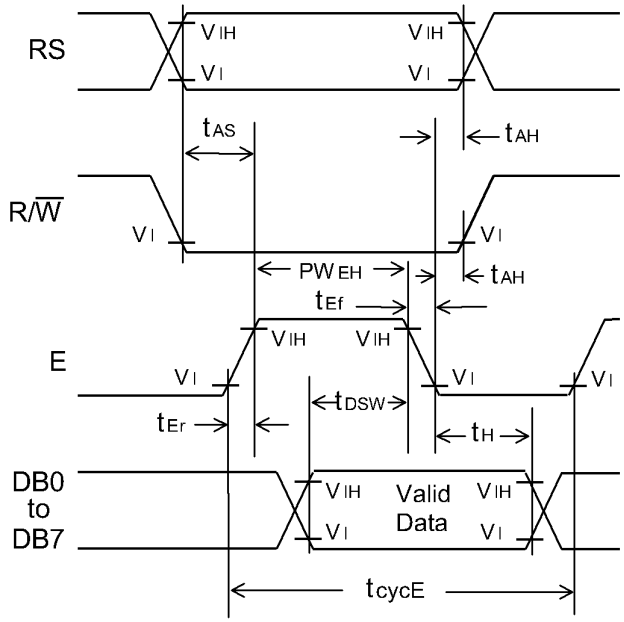
Pin No.	Symbol	I/O	Function
1	V_{SS}	-	Ground (0V)
2	V_{DD}	-	Logic Supply Voltage (+5V)
3	V_O	-	LC Drive voltage for contrast adjustment
4	RS	I	Register Select 0: Instruction Register 1: Data Register
5	R/W	I	Read / Write 0: Data Write (Module←MPU) 1: Data Read (Module→MPU)
6	E1	I	Enable Signal 1 Active High (H→L)
7	DB0	I/O	Bi-directional data bus line 0
8	DB1	I/O	Bi-directional data bus line 1
9	DB2	I/O	Bi-directional data bus line 2
10	DB3	I/O	Bi-directional data bus line 3
11	DB4	I/O	Bi-directional data bus line 4
12	DB5	I/O	Bi-directional data bus line 5
13	DB6	I/O	Bi-directional data bus line 6
14	DB7	I/O	Bi-directional data bus line 7
15	E2	I	Enable Signal 2 Active High (H→L)
16	N/C (V_{EE})	- (O)	No connection (Negative voltage output for models with on-board negative voltage generator)
BL1	V_{LED+}	-	Supply voltage for backlight (+5V)
BL2	V_{LED-}	-	Supply voltage for backlight (0V)



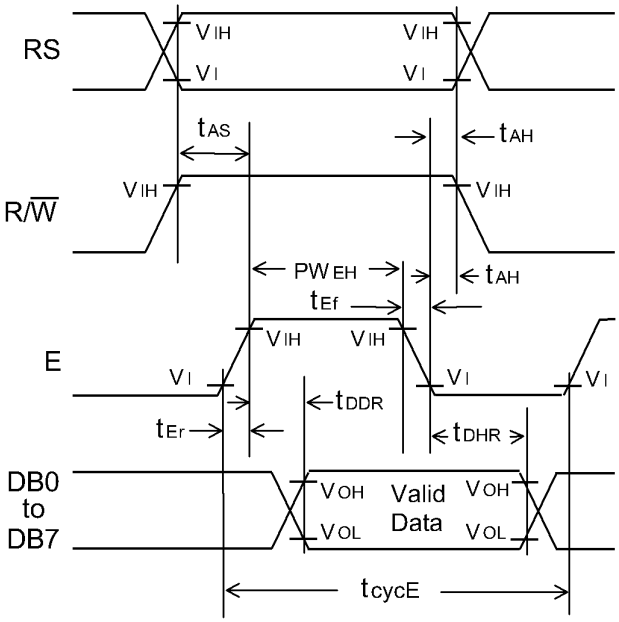
10.0 TIMING CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit
Enable cycle time	T_{cycE}	500	-	-	nS
Enable pulse width	PW_{EH}	230	-	-	nS
Enable rise / fall time	t_{Er}/t_{Ef}	-	-	20	nS
Address set-up time	t_{AS}	40	-	-	nS
Address hold time	t_{AH}	10	-	-	nS
Data delay time	t_{DDR}	-	-	160	nS
Data hold time (Write)	t_{DHW}	10	-	-	nS
Data hold time (Read)	t_{DHR}	5	-	-	nS
Data set-up time	t_{DSW}	80	-	-	nS

WRITE OPERATION



READ OPERATION



11.0 DD RAM ADDRESS vs. DISPLAY POSITION

Character	1	2	3	4	5	6	7	8	9	10	11	---	38	39	40
Line 1 *	00	01	02	03	04	05	06	07	08	09	0A	---	25	26	27
Line 2 *	40	41	42	43	44	45	46	47	48	49	4A	---	65	66	67
Line 3 **	00	01	02	03	04	05	06	07	08	09	0A	---	25	26	27
Line 4 **	40	41	42	43	44	45	46	47	48	49	4A	---	65	66	67

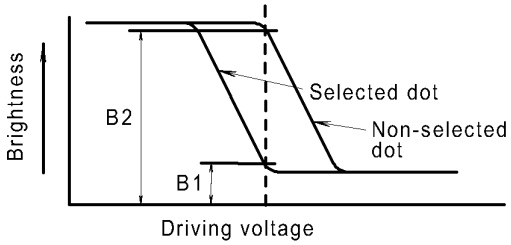
* - Controller 1 (E1)
** - Controller 2 (E2)

12.0 OPTICAL CHARACTERISTICS

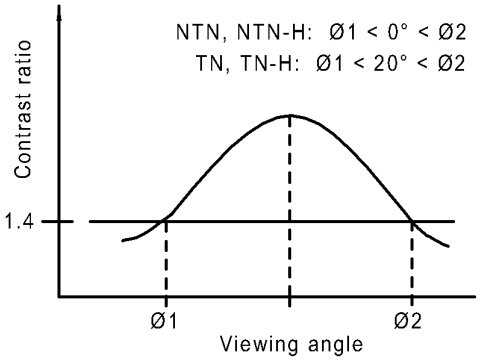
Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Contrast ratio TN, TN-H	K	Ø=20° θ=0°	3	-	-	-
Contrast ratio NTN	K	Ø=20° θ=0°	4	-	-	-
Contrast ratio NTN-H	K	Ø=20° θ=0°	5	-	-	-
Viewing angle TN, TN-H	Ø2-Ø1	θ=0° K≥1.4	20	-	-	Deg.
	θ	Ø=20° K=1.4	±30	-	-	Deg.
Viewing angle NTN	Ø2-Ø1	θ=0° K≥1.4	40	-	-	Deg.
	θ	Ø=20° K=1.4	±30	-	-	Deg.
Viewing angle NTN-H	Ø2-Ø1	θ=0° K≥1.4	40	-	-	Deg.
	θ	Ø=20° K=1.4	±40	-	-	Deg.
Response time Rise	t_r	Ø=20° θ=0°	-	150	250	mS
Fall	t_f	Ø=20° θ=0°	-	150	250	mS

DEFINITION OF CONTRAST RATIO (K)

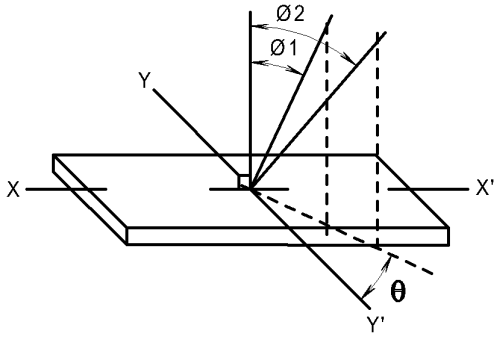
$$K = \frac{\text{Brightness of non-selected dots}}{\text{Brightness of selected dots}}$$



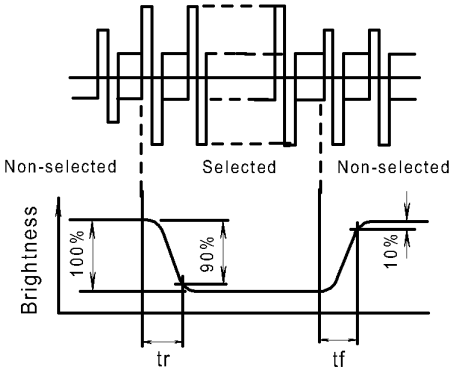
CONTRAST VERSUS VIEWING ANGLE



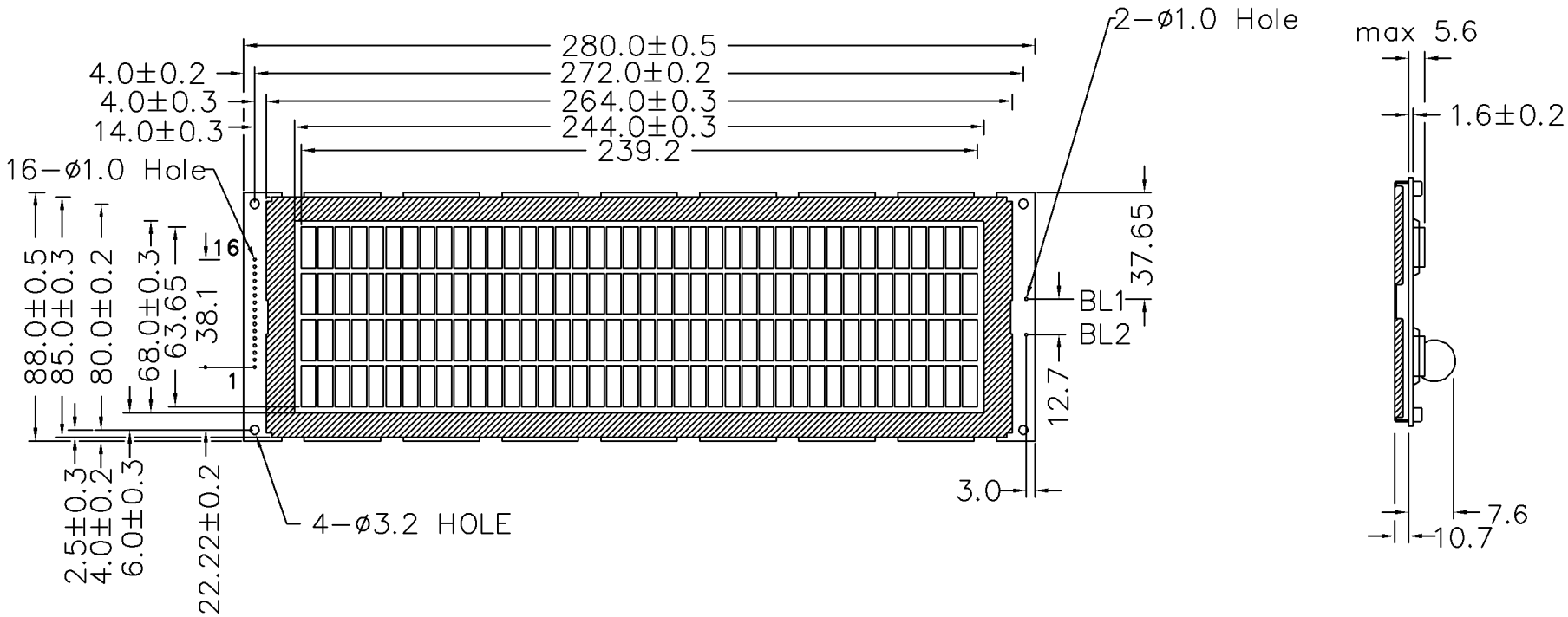
DEFINITION OF ANGLES Ø AND θ

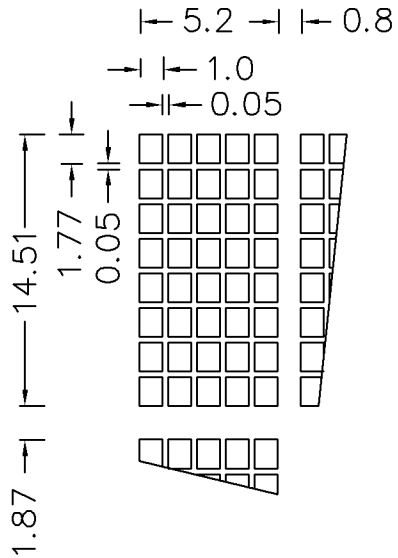


DEFINITION OF OPTICAL RESPONSE



13.0 MODULE DIMENSIONS





DWG. NO.		REV.
LM4790	SHEET 7 of 8	-

14.0 PART NUMBER DESCRIPTION FOR AVAILABLE OPTIONS

LM4790①②4C40③④⑤

OPTION 5.DOC

①

Polarizer Type

B = Transflective: light background with LED backlight
E = Transmissive: dark background with LED backlight
F = Transmissive: light background with LED backlight

②

Backlight Color

G = Yellow-green (standard)
R = Red

③

Fluid Type and Power Supply

S = NTN with +5VDC operation
H = NTN-H with ±5VDC operation
W = NTN-H with +5VDC operation (on-board negative voltage generation)

④

Fluid Type

N = NTN, NTN-H

⑤

Background Color for NTN Fluid

B = Blue background
G = Gray background
Y = Yellow background

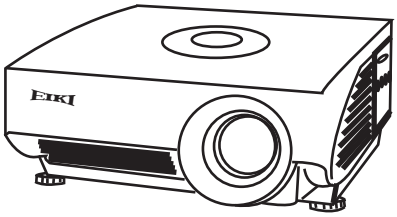
EIP-5000

XGA Conference DLP® Projector

A-key to better communications.

KEY FEATURES: Model EIP-5000

5200 ANSI Lumens bright, at 90% uniformity, and 1200:1 contrast ratio.
XGA resolution. UXGA, SXGA+, SXGA, SVGA, VGA & MAC compatible.
DLP™ imaging technology delivers a "seamless" high contrast image.
Power Zoom and Focus Lens. Optional Wideangle and Telephoto lenses.
Horizontal & Vertical Lens Shift. H. V & Geometric Keystone Correction.
Dual Lamp System provides redundancy and permits 4 brightness levels.
Wireless/wired remote. Computer mouse control. 8-power digital zoom.
RS-232 System and Network Control Compatible: Built in DB9, and RJ45.
Smart data compression / expansion, and video scaling. sRGB Compatibility.
Displays both Regular 4:3 and Widescreen 16:9 ratio video formats.
Converts Interlace video to Progressive scan. 2-3 Pulldown Support.
Accepts Analog and Digital (DVI w/HDCP) Video input signals.
Power Management, Keylock Security, and Custom Warmup Screen options.
Unique Projector Stack Control and VideoWall Signal Division features.
3 Year* Projector Warranty!



EIP-5000

Included Accessories: Operation manual. CD-Rom (Setup Guide). System lock caution. Quick guide. AC Power Cord 12 ft. (3.6M). Lens Cover. VGA type Computer Input Cable 9.8 ft. (3m). Wireless/wired Remote With Mouse Control and & (2 x AA) Batteries. Remote Mouse Receiver on 5.25ft. (1.6M) USB-A cable.

Optional Accessories: Replacement Lamps. Soft Carry Bag with Wheels and Telescoping Handle. ATA-Style Shipping Case with Wheels and Telescoping Handle. Wideangle and Telephoto lenses. Ceiling Mount. Ceiling Post and Plate. EZ-250 Local Control.

SPECIFICATIONS: Model EIP-5000

Screen Brightness	up to 5200 ANSI Lumens
Illumination Uniformity	90%
Size of Color Palette	16.7 Million
Contrast Ratio	1200:1
Horizontal Resolution	750 TV Lines (S-Video)
Projection Lamp	260 Watt UHP x 2
Estimated Lamp Life	up to 3000 Hours of Use
Imaging System	0.7" DDR DLP™ Single DMD™
Color System	4-Segment, 3X speed color wheel
Screen Pixels	786,432 (1024x768) in stripe configuration
Lens Type	Power Zoom and Focus
Lens Specs	Speed: f:1.8~2.0; FL: .1.01~1.23in. (25.6~31.3 mm)
Lens Ratios	Zoom Max:Min: 1.22:1; Throw:Width: 1.8~2.2:1
Image Diagonal	40~500 in. (102~1270 cm)
Image Width	2.5~33.3 ft. (0.81~10.16 m.)
Throw Distance	4.8~44 ft. (1.5~13.4 m.)
Front Elevation / Maximum Pitch	up to 9° up
Vertical Anti Keystone	Power Lens Shift (Top:Bottom)10:0 ~ 1:1
Horizontal Anti Keystone	Power Lens Shift (L:R~R:L) 6.5:3.5~3.5:6.5
Vertical Keystone Correction	Digital: up-to 30° up or down
Horizontal Keystone Correction	Digital: up to 30° left or right
Geometric Keystone Correction	Digital
Scanning Frequency	Auto: H Sync. 15-126 kHz; V Sync. 43-200 Hz
Dot Clock	12~230 MHz
Image Orientation	Normal, Reversed, Inverted
Local Control / Power Management	Full Function / Auto Shut-Off
Remote Projector & Mouse Ctrl	Wireless/wired x 1
Computer Mouse Control	via External IR Receiver on USB-A cable
Wired Remote Port	MiniStereo x 1
RS-232 Port	DB9 x 1
LAN Port	RJ45 x 1
Computer Native Resolution	1024x768 (XGA)
Computer: Compatibility	UXGA, SXGA+, SXGA, WXGA, XGA, SVGA, VGA & MAC: 13~21; Workstation: SUN, SGI
Computer: Formats	1600 x 1200 through 640 x 480
Computer: Image Sizing	Normal, or Smart Compressed or Expanded
Video: Color Systems	NTSC/PAL/SECAM/NTSC 4.43 / PAL-M&N
Video: Aspect Ratios Supported	4:3 & 16:9

Video: Resolutions Supported	
SDTV (Composite, S-Video, Component)	480i / 540p, 576i
EDTV (DVI w/HDCP)	480p, 576p
HDTV (DVI w/HDCP)	720p (50/60), 1035i (50/60), 1080i (50/60)
Signal Inputs:	
1. Computer: Analog RGB	HD15 x 1
plus Audio: Stereo:	MiniStereo x 1 (L & R)
2a. either Computer: (RGBHV)	BNC x 5
2b. or Video: (RGBHV)	BNC x 5
or (Composite/Component: Y, Pb/Cb, Pr/Cr)	BNC x 3
plus, Audio: Stereo: (L&R) (shared with input 3)	MiniStereo x 1
3a. either Computer - Digital RGB:	DVI-D x 1
3b. or Video - Digital HDCP: (same)	DVI-D x 1
plus, Audio: Stereo: (L&R) (shared with input 2)	MiniStereo x 1
4. Video: Composite -	RCA x 1
plus, Audio: Stereo: (L&R) (shared with input 5)	MiniStereo x 1
5. Video: S-Video -	S-Video x 1
plus, Audio: Stereo: (L&R) (shared with input 4)	MiniStereo x 1
Signal Outputs:	
Data/Video Monitor	HD15 x 1 on input 1 (shared: input 1 & 2)
Audio Line:	Stereo: Ministereo x 1 (L & R) (follows video)
Audio: Amplifier	Stereo: 3 Watts
Audio: Built In Speakers	Stereo: 1.8 in. (4.5 cm) diameter (round) x 2
Operating Noise	as low as 35 dBA
Cabinet Size (HxWxD)	7.1 x 16.1 x 18.5 in. (180 x 410 x 471 mm.)
Overall Size (HxWxD)	7.6 x 16.2 x 18.5 in. (193 x 412 x 470mm.)
Weight	33.2 lbs. (15.1 kg)
Packaged Size	15.4 x 22 x 24.4 in. (390 x 560 x 620 mm.)
Packaged Weight	46.3 lb. (21 kg.)
Power Requirements	100-240V AC, 50/60Hz
Power Consumption	up to 650 W
Heat	up to 2,218 BTU/hr. (559 Kcal/hr)
Power Cord	11.8' (3.6M) Type 3, Detachable
Safety Compliance	UL / cUL
Security Facilities	Kensington® Security Slot
Operating Temperature	41~104^{0}F (5~40^{0}C)
User Maintenance	Clean Air Vents/Covers, Replace Lamp
Warranty (to original end use customer)	
Projector :	3 Yr. / 6000 Hr. *(Parts & Labor to Correct Defects)
Lamp:	90 Days (Failed Lamp Replaced Pro-Rata)
	* Whichever occurs first

Lamp contains Mercury. Do not put in trash. Dispose of as Hazardous Waste, according to Local, State or Federal Laws.

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Visit our World Wide Web site: http://www.eiki.com

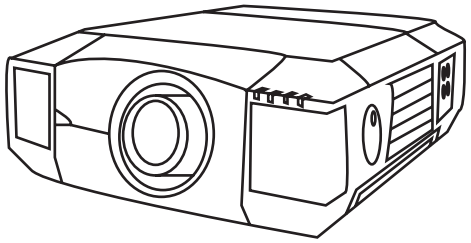
EIKI
A-key to better communications.

LC-XT4

XGA Theater Projector

KEY FEATURES: Model LC-XT4

12,000 ANSI Lumens bright at 90% uniformity and a 1300:1 contrast ratio.
Native XGA. Compatible with UXGA through VGA. WXGA compatible. Video scaling.
Works on 120V AC power (20 amp circuit). No special wiring required.
Projects images up to 40' wide (600" diagonal). (Supplied without lens.)
Quick Change Lens Installation system. Wide choice of lenses available.
Improved Power Lens Shift. Lens can be shifted vertically and horizontally.
Compatible with most video signal input, including DVI, RGB, Y/C, DVD, HDTV.
Displays video 4:3 & 16:9 in NTSC/PAL/SECAM/NTSC 4.43/PAL-M/PAL-N.
DVI input supports HDCP for true digital imaging. 2-3 pulldown support.
4 input channels. Interchangeable input modules permit reconfiguration.
Supplied software permits the preconfiguring of color adjustments.
Wireless/wired remote control. Digital Zoom 50% ~ 700% (horizontal).
Capable of extended operation (up to 23 hours / day) with regular maintenance.
3 Year / 6000 Hr.* Warranty.



LC-XT4
Supplied without lens. Shown with lens

Breakthrough Features

1. Amazing Brightness: 12,000 ANSI Lumens.
2. Remarkable Contrast: 1300:1.
3. New imaging technology minimizes optical system degradation in extended operation.

INCLUDED ACCESSORIES - Owner's Manual on CD-ROM. Quick Start Manual. AC Power Cord 10' (3.m). Lens Aperture Cover. Computer Input Cable 6' (1.8m) HD15~HD15. Wireless/wired Remote with Mouse Control & 2 x AA batteries and 1.5M wired remote cable. Color Management Software. Lens Mount Adapter x 2.

OPTIONAL ACCESSORIES - Telephoto, Midrange and Wideangle Lenses. Replacement Lamps. Additional DVI, 5 BNC, Y/C and PC Input Modules. DVI-I w/HDCP (Digital Video) Input Module. Dual (HD & SD) SDI Input Module. HD-SDI Input Module. Upconverter Input Module. Network Control Module. Hard Shipping Case with wheels and Telescoping handle. Ceiling Mount and Post & Plate. EZ-250 Local Control. NPC-1 Network Control.

SPECIFICATIONS: Model LC-XT4

Brightness	12,000 ANSI Lumens (10,000 in Eco mode)
Uniformity	90%
Size of Color Palette	16.7 Million
Contrast Ratio	1300:1 (Typical lamp control mode "Auto")
Horizontal Resolution	800 TV Lines(HDTV)
Projection Lamp	300 Watt UHP x 4
Estimated Lamp Life	2000 hrs
Imaging System	1.8" PolySilicon active matrix TFT Panels x 3
Screen Pixels	1024 x 768 in stripe configuration
Total Pixels	2,359,296 ((1024 x 768) x 3)
Lens	Not Included
Image Diagonal	40~600 in (101.6~1524cm).
Image Width	2.67 ~ 40 ft. (0.82 ~ 12.2m)
Throw Distance	See specifications of selected lens
Front Elevation / Maximum Pitch	up to 5.7° up
Lateral Anti-keystone	Power Lens Shift , Ratio (L:R) 3:2~2:3
Vertical Anti-Keystone	Power Lens Shift, Ratio (max.) (T:B) 10:0~0:10
Vertical Keystone Correction	Digital: Variable Adjustment +30°~ -30°
Scanning Frequency	Auto: H Sync. 15-120kHz; V Sync. 50-120Hz
Dot Clock	230 MHz
Image Orientation	Normal, Reversed, Inverted
Local Control / Power Management	Full Function / Auto Lamp Shut-Off
Remote Projector & Mouse Ctrl	Wireless/Wired x 1
Mouse Control Ports	(On input modules 1, 2 & 4) Mini DIN x 3 USB x 1
Wired Remote Jack	Mini Stereo x 1
RS-232 Control Port	Dsub9 x 2 (In & Out)
Computer Native Resolution	1024 x 768 (XGA)
Computer Compatibility	UXGA, SXGA+, SXGA, WXGA, XGA, SVGA, VGA & MAC
Computer: Image Sizing	Normal or Smart compressed or expanded
Video: Standards	NTSC/PAL/SECAM/NTSC 4.43/PAL-M/PAL-N
Video: Formats Supported	Normal 4:3 and Wide Screen 16:9
Video: Image Sizing	Progressive Video Scaling
Video: Systems	Composite, Component, S-Video
Input Channels	4
Input Modules	Interchangeable: standard configuration below
1: DVI:	DVI-I x 1 data/video, RCA x 2 audio, 8-pin DIN x 1 control (provides DVI digital data, HD15 analog data via adapter and DVI w/HDCP digital video)
2: RGB/DVD/HD	BNC x 5 video, RCA x 2 audio, 8-pin DIN x 1 control (RGB G-sync, RGB H+V, RGBHV, Component and Y, Pb/Cb, Pr/Cr)
3: Y/C	BNC x 2 & S-Video x 1 video, RCA x 2 audio
4: PC	HD15 x 1 data, RCA x 2 audio, 8-pin DIN x 1 control
Audio: Output - Line	(Stereo) RCA x 2 (L & R)
Fan Noise	51 Typical dBA
Size (H x W x D)	9.9 x 22.9 x 30.8 in. (251.5 x 581.2 x 783 mm.)
Weight	80.5 lbs.(36.5 kg)
Packaged Size (H x W x D)	26.1 x 34.7 x 48.4 in. (662 x 880 x 1228)
Packaged Weight	109.1 lb. (49.5 kg)
Power Requirements	100~120/200~240V AC, 50/60Hz (Japan 200V)
Power Consumption / Heat	Max:1800W / 6142 BTU/hr (1548 Kcal/hr)
Power Cord	10' (3.m) Type 3, Detachable
Safety Compliance	UL Listed
Operating Temperature	41~95^{0}F (5~35^{0}C)
User Maintenance	Clean Air Filter, Replace Lamp
Warranty: (to the original end-use customer)	
Projector	3 Yr / 6000 Hr *(Parts/Labor to Correct Defects)
Lamp	90 Days (Failed Lamp Replaced Pro-Rata)
	* whichever occurs first

Lamp contains Mercury. Do not put in trash. Dispose of as Hazardous Waste, according to Local, State or Federal Laws

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1939L 19" LCD Open-Frame Touchmonitor

Features • Specifications • Documentation • Support • Part Numbers • Pricing • Accessories

Elo's chassis LCD monitors have a long-lasting product cycle because the enclosure is controlled by Elo's specifications. Future panel improvements are therefore possible without external changes. The 1939L features a wide viewing angle panel along with a unique, injection-molded minibezel and virtually invisible watertight seal. Available with a choice of touch technology including clear glass IntelliTouch surface wave for the utmost in optical quality.

Features

- High quality panel with 170°x170° viewing angle
- 1000:1 contrast ratio
- Fully RoHS compliant
- Long lasting product cycle-enclosure controlled by Elo specifications
- Future generation panels phased-in without external changes
- Integrated precision minibezel with watertight 0.5 mm seal
- Mounting options including rear-mount and VESA mount
- IntelliTouch or SecureTouch surface wave, AccuTouch Five-Wire Resistive, CarrollTouch Infrared and Surface Capacitive touch technology with dual serial/USB touch interface; Acoustic Pulse Recognition touch technology with USB touch interface
- Multilingual on-screen display (OSD)
- Worldwide agency approvals
- 3-D electronic design files available

Specifications

Model	1939L
Availability	See Part Numbers
Case/bezel color	Steel/black
Display	Size: 19.0" diagonal Type: Active matrix TFT LCD Aspect ratio: 5 x 4
Useful screen area	Horizontal: 14.8" (376 mm) Vertical: 11.9" (301 mm)
Monitor dimensions	Width: 16.3" (415 mm) Height: 13.5" (343 mm) Depth: 2.0" (51 mm)
Optimal (native) resolution	1280 x 1024
Other supported resolutions	1280 x 1024 at 60, 70 or 75 Hz 1280 x 960 at 60 Hz 1152 x 864 at 75 Hz 1024 x 768 at 60, 65 (Sun), 70 or 75 Hz 832 x 624 at 75 Hz (Mac) 800 x 600 at 56, 60, 72 or 75 Hz 720 x 400 at 70 Hz 720 x 350 at 70 Hz 640 x 480 at 60, 66 (Mac), 72 or 75 Hz 512 x 247 at 60 Hz (CGA)

	512 x 256 at 60 Hz (CGA)
Colors	16.7 million
Brightness	LCD panel: 250 cd/m^2 (typical) with AccuTouch: 200 cd/m^2 (typical) with Acoustic Pulse Recognition: 230 cd/m^2 (typical) with CarrollTouch: 230 cd/m^2 (typical) with IntelliTouch: 230 cd/m^2 (typical) with SecureTouch: 230 cd/m^2 (typical) with surface capacitive: 212 cd/m^2 (typical)
Response time	22 msec (typical)
Viewing angle (typical, from center)	Horizontal (left/right): ±89° or 178° total Vertical (up/down): ±89° or 178° total
Contrast ratio	1000:1 typical
Input video format	RGB analog only
Input sync format	Separate horizontal and vertical sync, composite sync and sync-on-green
Input video signal connector	Mini D-Sub 15-Pin VGA type
Input frequency	Horizontal: 31.5-80.0 kHz Vertical: 56.3-75 Hz
Power supply	Type: External AC to DC power brick Monitor input: +12VDC ±5%, 3.2 A typical, 3.8 A max. AC to DC power brick input: 100-240 VAC, 50/60 Hz
Power dissipation	Monitor only: 38 W typical, 46 W max. Monitor and power brick: 43 W typical, 50 W max.
Temperature	Operating: 0°C to 40°C Storage: -20°C to 60°C
Humidity	Operating: 20%-80% Storage: 10%-90% noncondensing
Weight (approx.)	Actual: 11.5 lb (5.2 kg) Shipping: 16.1 lb (7.3 kg) Shipping box dimensions
Warranty	Monitor: 3 years Backlight lamp life: typical 50,000 hours to half brightness MTBF: 50,000 hours demonstrated
Agency approvals	North America/Worldwide: UL, cUL (Recognized), TÜV-T Mark, Argentina S, CE, FCC, VCCI, IC, C-Tick (Class B) Asia: UL, cUL (Recognized), TÜV-T Mark, Argentina S, CE, FCC, VCCI, IC, C-Tick (Class B), BSMI, MIC, CCC, China RoHS
On-screen display (OSD)	Digital OSD or optional remote OSD with 1.8m cable
User's controls	Optional remote OSD: Auto/Sel, up, down, menu OSD buttons: menu, left, right, select, power OSD: contrast, brightness, H/V position, RGB (color temp), clock, phase, recall, language (English, German, Spanish, Japanese, French) OSD disable/enable: power, OSD menu
Mounting options	75 mm or 100 mm VESA mount Rear mount or with included standard mounting brackets Front mount with optional bezel (see Accessories for details) Rack mount with optional bracket (see Accessories for details)
Other features	Fully RoHS compliant Patent pending bezel seal Patented touch technology

Documentation

- Dimensional drawing: MS500786 Rev E (865K PDF)
- CAD drawings available upon request
- User Guide (516K PDF)
- Product data sheet (111K PDF)
- Agency approval certificates (1.0 MB PDF)
- WEEE report (198K PDF)
- Look up the RoHS declaration of compliance by part number

Support

- Drivers
- Platform support
- Technical topics
  - Dual serial/USB controllers
  - Long cables
  - How to mount an open-frame LCD

Part Numbers

All monitors have antiglare surface treatment.

Touch Technology	Touch Interface	Part # (RoHS Compliant)	Availability
AccuTouch	Dual serial/USB	E171252	Everywhere except Asia
Acoustic Pulse Recognition	USB	E810857	Everywhere except Asia
CarrollTouch	Dual serial/USB	E757389	Everywhere except Asia
IntelliTouch	Dual serial/USB	E226971	Everywhere except Asia
SecureTouch	Dual serial/USB	E071566	Everywhere except Asia
Surface capacitive	Dual serial/USB	E665102	Everywhere except Asia
AccuTouch	Dual serial/USB	E138057	Asia
Acoustic Pulse Recognition	USB	E258553	Asia
CarrollTouch	Dual serial/USB	E907238	Asia
IntelliTouch	Dual serial/USB	E638303	Asia
			Asia = China, Taiwan, Korea

Pricing

For pricing information, please:

- login to shop online (U.S. delivery only)
- contact an Elo office
- request a quotation
- contact an authorized Elo distributor (resellers/OEMs only)

Accessories

Front-Mount Bezel: For front mounting. North America part number E163604, available at additional cost. See the dimensional drawing (under Documentation, above) for mounting options and details.

IntelliTouch Stylus Pen: Stylus pen with rubber tip, designed specifically for use with IntelliTouch surface wave touch technology. Part number D82064-000, available at additional cost.

Optional Mounting Brackets: Two standard ("L") mounting brackets are included; additional set of two, part number E147211, available at additional cost, minimum shipment quantity of 50 sets.

Power Cable: A North American power cable and a European power cable are included. For touchmonitors being shipped to the United Kingdom, add a UK power cable at no cost by specifying part number E235317.

Rack-Mount Bracket: For compatibility with 19" industrial racks. North America part number E579652, available at additional cost. See the dimensional drawing (under Documentation, above) for mounting options and details.

Remote On-screen Display (OSD): With 1.8 m cable. Part number E622897, available at additional cost.

Replacement Power Supply Brick: Part number E785134, available at additional cost. Power cables for power brick, also available at additional cost:

- United States: part number E042259
- European: part number E690013

- United Kingdom: part number E235317

Touch/Video Cables: Detachable touch and video cables are included.

1247L 12" LCD Open-Frame Touchmonitor

1247L 12" LCD Open-Frame Touchmonitor - Angled View

Features • Specifications • Documentation • Support • Part Numbers • Pricing • Accessories

Elo's chassis LCD monitors have a long-lasting product cycle because the enclosure is controlled by Elo's specifications. Future panel improvements are therefore possible without external changes. The monitors are available with multiple touch technologies and all feature a unique, injection-molded minibezel and watertight seal, plus a multitude of mounting options.

Features

- Higher brightness, better contrast, and wider viewing angle than most 12" LCDs (300 cd/m^2, 300:1, 120° x 90°)
- Up to 800 x 600 resolution at 75 Hz
- Long lasting product cycle-enclosure controlled by Elo specifications
- Future generation panels phased-in without external changes
- Integrated precision minibezel with watertight 0.5 mm seal
- Multiple mounting options including rear-mount or VESA mount
- IntelliTouch Surface Wave Technology on pure glass for the ultimate in image quality
- Finger or gloved hand operation
- Serial touch interface
- Multilingual remote on-screen display (OSD)
- Worldwide agency approvals
- 3-D electronic design files available

Specifications

Model	1247L
Availability	Worldwide
Case/bezel color	Galvanized sheet metal; black plastic bezel
Display	Size: 12.1" diagonal Type: Active matrix TFT LCD Aspect ratio: 4 x 3
Useful screen area	Horizontal: 9.69" (246 mm) Vertical: 7.27" (184.5 mm)
Monitor dimensions	Width: 11.92" (302.5 mm) Width with bracket: 14.14" (359 mm) Height: 9.53" (242 mm) Depth: 2.36" (60 mm)
Optimal (native) resolution	800 x 600
Other supported resolutions	800 x 600 at 56, 60, 72 or 75 Hz 720 x 400 at 70 Hz 640 x 480 at 60, 66 Hz (Mac), 72 or 75 Hz 640 x 350 at 70 Hz
Colors	262,000
Brightness	LCD panel: 350 cd/m^2 (typical) with IntelliTouch: 320 cd/m^2 (typical)

Response Time	40 msec (typical)
Viewing angle (typical, from center)	Horizontal (left/right): ±65° or 130° total Vertical (up/down): 65°/40° or 105° total
Contrast ratio	500:1 (typical)
Input video format	RGB analog
Input video signal connector	Mini D-Sub 15-Pin VGA type
Input frequency	Horizontal: 31.5-48.1 kHz Vertical: 56.3-75 Hz
Power supply	Type: External brick Input (line) voltage: 100-240 VAC, 50-60 Hz Output voltage/current: 12 volts at 3.33 amps max
Temperature	Operating: 0°C to 40°C Storage: -20°C to 60°C
Humidity	Operating: 20%-85% Storage: 5%-95% noncondensing
Weight (approx.)	Actual: 8.8 lb (4 kg) Shipping: 13.2 lb (6.0 kg) Shipping box dimensions
Warranty	Monitor: 3 years Backlight lamp life: minimum 50,000 hours to half brightness
Agency approvals	UL/cUL (*recognized component), FCC, TÜV-Bauart, CE, VCCI, C-Tick
On-screen display (OSD)	Remote OSD with 1.8m cable
User's controls	Remote OSD: menu, down, up, auto/sel OSD: contrast, brightness, V/H position, recall default, RGB, OSD exit, sharpness, phase, clock, OSD H/V position, OSD time, auto adjust, OSD languages (English, French, German, Spanish, Japanese) and information
Mounting options	75 mm VESA mount Rear mount through bezel or with included standard mounting brackets Rack mount option
Other features	Energy save mode (less than 2 watts) 2 stage DPMS VESA DDC Plug and Play

Documentation

- Dimensional drawing: MS600157 Rev A (232K PDF)
- CAD drawings available upon request
- User Guide
  - English (642K PDF)
  - Spanish (Latin America) (266K PDF)
- Agency approval certificates (804K PDF)
- WEEE report (112K PDF)
- Look up the RoHS declaration of compliance by part number

Support

- Drivers
- Platform support
- Technical topics
  - Dual serial/USB controllers
  - Long cables

Part Numbers

All monitors have antiglare surface treatment.

Touch Technology	Touch Interface	Part # (RoHS Compliant)
IntelliTouch	Dual serial/USB	E655204

Pricing

For pricing information, please:

- login to shop online (U.S. delivery only)
- contact an Elo office
- request a quotation
- contact an authorized Elo distributor (resellers/OEMs only)

Accessories

IntelliTouch Stylus Pen: Stylus pen with rubber tip, designed specifically for use with IntelliTouch surface wave touch technology. Part number D82064-000, available at additional cost.

Power Cable: A North American power cable and a European power cable are included. For touchmonitors being shipped to the United Kingdom, add a UK power cable at no cost by specifying part number 276875-000.

Touch/Video Cables: Detachable touch and video cables are included.

tyco / Electronics

elo TOUCHSYSTEMS

1739L 17" LCD Rear-mount Touchmonitor

High quality panel and surface wave touch technology combined in a compact form factor

Applications

- Casino and amusement games
- Information kiosks
- Self-service
- Industrial process control

Elo's 1739L 17" LCD rear-mount touchmonitor delivers a cost-effective touch solution for OEM's and systems integrators, and complements Elo's expanding family of touch solutions for applications in the retail self-service and gaming/amusement markets. This compact 3000 series touchmonitor is "designed for touch" from the ground up, with Elo's proven expertise and reliability built in, and not added as an afterthought by altering an existing monitor.

The 1739L features a brilliant wide viewing angle panel to instantly grab and hold the users' attention, whether they are checking out retail goods with a self-service kiosk or playing games in a casino or arcade. Because the enclosure is controlled by Elo's specifications and tooling, Elo's rear-mount monitors have a long-lasting product cycle—important for continuity through all phases of project rollouts and when servicing. The 1739L uses clear glass IntelliTouch surface wave technology for the utmost in optical quality, durability, and drift-free stability. It also features a unique, injection-molded minibezel with virtually invisible watertight seal, making it ideal for the rigors of public use.

Narrow borders, multiple mounting options, and a dual serial/USB touch interface add to the versatility of the 1739L. Worldwide agency approvals, as set forth on the back side of the spec sheet, cover the entire monitor that is designed, built and supported by Elo, a true single source supplier.

Benefits

- Bright, high contrast display with wide viewing angle to attract and hold users' attention
- Elo's pure glass IntelliTouch surface wave technology for excellent optics, durability, and long-term reliability
- "Designed for touch" from the ground up: includes Elo's patented protective minibezel for sealing against liquids
- Slim and compact outer dimensions
- Long lasting product cycle–enclosure controlled by Elo specifications
- Multiple mounting options
- Dual serial and USB connectivity
- Worldwide agency approvals
- Three-year standard warranty
- Designed, built, and supported by Elo

tyco / Electronics

elo TOUCHSYSTEMS

1739L 17" LCD Rear-Mount Touchmonitor Specifications

Model	1739L
Case/bezel color	Steel/black
Display type	Active matrix TFT LCD
Display size	17.0" diagonal
Useful screen area Horizontal/vertical	 13.3" (338 mm)/10.6" (270 mm)
Monitor dimensions	Width: 14.5" (368 mm) Height: 12.0" (306 mm) Depth: 1.9" (49 mm)
Optimal (native) resolution	1280 x 1024
Other supported resolutions	1280 x 1024 60, 70, 75 Hz; 1280 x 960 60 Hz; 1152 x 864 75 Hz; 1024 x 768 60, 70, 75 Hz; 1024 x 768 65 Hz (Sun); 832 x 624 75 Hz (Mac); 800 x 600 56, 60, 72, 75 Hz; 720 x 400 70 Hz; 720 x 350 70 Hz; 640 x 480 60, 72, 75 Hz; 640 x 480 66 Hz (Mac)
Colors	16.7 million colors
Brightness (typical) LCD panel LCD panel with IntelliTouch LCD panel with surface capacitive LCD panel with CarrollTouch	 280 cd/m^2 257 cd/m^2 238 cd/m^2 257 cd/m^2
Response time (typical) Rise/fall	 15 msec/10 msec
Viewing angle (typical at CR>10) Horizontal (left/right) Vertical (up/down)	 89°/89° 89°/89°
Contrast ratio	1500:1
Input video format	RGB analog
Input sync format	Separate H & V sync, composite sync, and sync-on-green
Input video signal connector	Mini D-Sub 15-Pin VGA type
Scanning frequency Horizontal/vertical	 31.5 - 80.0 kHz/56.3 - 75 Hz
Power dissipation Monitor only Monitor and power brick	 36 W (max.) 40 W (max.)
Power supply	External AC to DC power brick is provided
Input voltage requirement Monitor input AC to DC power brick input	 +12VDC +/- 5%, 2.5A typical, 3.0A maximum 100-240 VAC, 50/60Hz
Temperature Operating/storage	 0°C to 40°C/-20°C to 60°C
Humidity (noncondensing) Operating/storage	 20% to 80%/10% to 90%
Mean time between failures (MTBF)	50,000 hours demonstrated
Backlight lamp life (typical)	50,000 hours to half brightness
Weight (approx.) Actual/shipping	 4.0 kg (8.8 lbs)/5.2 kg (11.5 lbs)
Other features	Digital on-screen display (OSD); Fully RoHS Compliant; Patent pending bezel seal and patented touch technology
Mounting options	75 mm and 100 mm VESA mounting; rear mount with or without bezel, mounting brackets (included)
User's controls	OSD buttons: menu, left, right, select, power; OSD: contrast, brightness, H/V position, RGB (color temp), clock, phase, recall, language (English, German, Spanish, Japanese, French); OSD disable/enable and power disable/enable
Warranty	Touchmonitor: 3 years
Touch interface	Serial and USB
Agency certifications	UL, cUL, SEMKO, CB, TÜV-T, CE/FCC/VCCI/IC/C-TICK (Class B)

Find out more about Elo's extensive range of touch solutions. Go to www.elotouch.com, or simply call the office nearest you.

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36" Focused Audio Array: Model FA-501

Technical Documentation

- Best Sound Quality of any focused sound technology
- Not an ultrasonic solution—no safety concerns
- Greatest low frequency capability in the industry
- Excellent Sound & Pattern Control via onboard user interface
- Custom Configuration/Enclosure and Cover colors available
- Built in Amplifier with balanced, line level input

Specifications

Maximum Output Level:
85dBA (8' MOUNTING HEIGHT, TIGHT PATTERN).

Size:
36.25 x 36.25 x 3 INCHES

Weight:
37 POUNDS

Color-Finish:
NON REFLECTIVE BLACK POWDER COAT

Cover:
BLACK, WHITE, OR CREAM FLAME-RETARDING CLOTH—CUSTOM COVERS AVAILABLE

Input Level:
ADJUSTABLE -15DBV TO +4DBV

Input Impedance:
5,000 OHMS TRANSFORMER BALANCED

Focal Pattern:
ADJUSTABLE FROM TIGHT TO 10 FEET IN DIAMETER

Mounting:
FOUR 0.080 AIRCRAFT CABLES WITH QUICK RELEASE CLIPS OR FOUR THREADED INSERTS (1/4" OR 6MM)

Frequency Response:
SEE ATTACHED CHARTS

Frequency Compensation:
SWITCH SELECTABLE: MUSIC, VOICE WITH MUSIC, VOICE

Power:
16 TO 18 VAC OR 24VDC, 15 WATTS

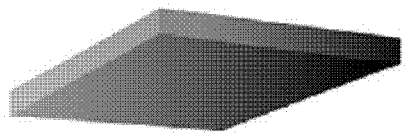
Connections:
SCREW TERMINALS ON TOP SIDE

1815 Michigan Avenue
Bismarck, ND 58504
www.dakotaaudio.com

Phone: 701-224-9331
Fax: 701-223-1296
Toll free: 800-428-3461

Dakota Audio FA-501 arrays are easily field adjustable for both mounting height and pattern width. There are two push buttons and two rows of LEDs on the top side of the array. One sets the mounting height above the floor in one foot increments from 8 to 14 feet. The other button controls the pattern width in seven steps from "tight" to a circle appropriately 10 feet in diameter.

A three position switch adjusts the frequency response for the program material. The "music" position provides full range sound. The "voice with music" position has a slight rise in the high frequency response to enhance voice intelligibility while maintaining good music reproduction. The "voice" position reduces low frequencies for maximum voice intelligibility.



Model FA-501

3"x36"x36" - with user control panel

Audio input is line level, transformer isolated. The array accepts any standard line level input, either balanced or unbalanced. A volume control and two position gain switch accommodate a wide range of audio input levels.

For installations where the audio level is set remotely, a switch disables the volume control.

The arrays are powered by either 16 to 18 Volts AC or 24 Volts DC. A plug-in 16 VAC transformer is supplied for installations where local 120 power is available. Where the array power and signal cables share the same conduit, we suggest powering them with 24VDC.

Generally, the arrays are suspended by four thin (0.080 inch) aircraft cables with easily adjustable clips (supplied). Optionally, four threaded inserts, either 1/4 - 20 American or 6 millimeter metric, are available.

The units are constructed of aluminum, with a non-reflective black powder coat finish. The snap-on fabric cover is provided, available in back, white, and cream with other colors available. Logos or designs can be printed on the face of the fabric.

Digital Signage	**Museum Exhibits**	**Supermarkets**
Trade Show Booths	**Waiting Areas**	**Retail**
Healthcare	**Education**	**Libraries**

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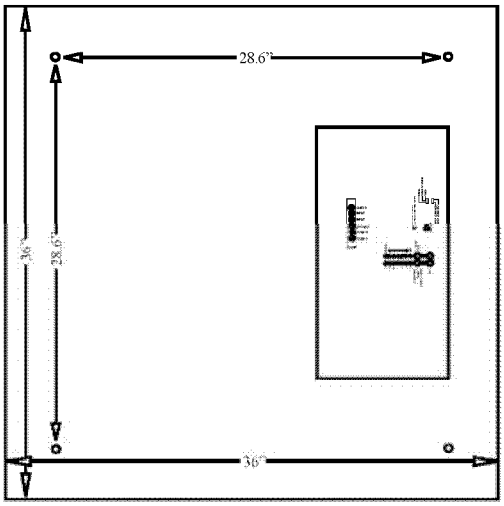
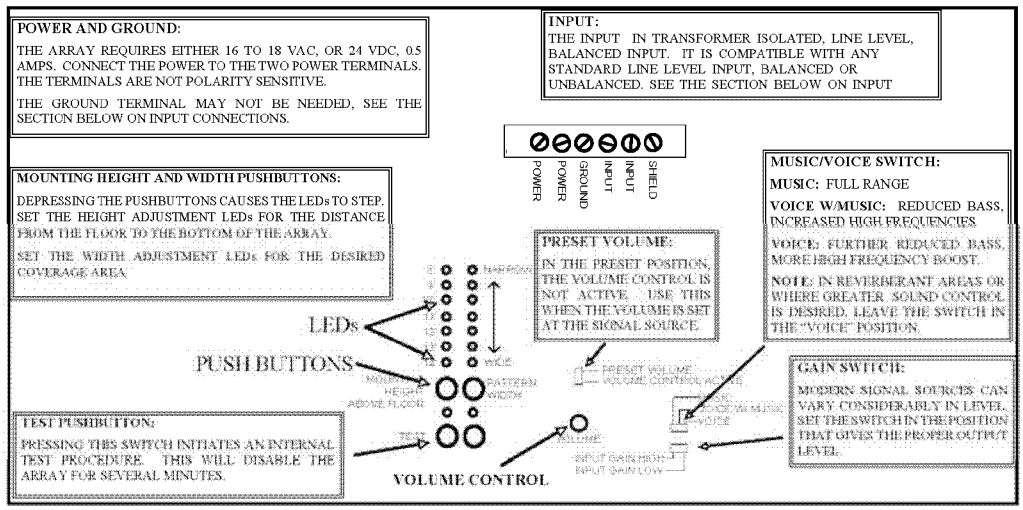
MECHANICAL DRAWING, OPERATION, & CONNECTIONS

BACK SIDE SHOWING
MOUNTING HOLES



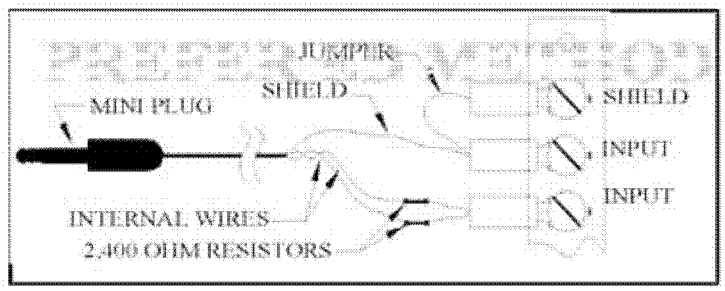
CONTROLS &C ONNECTIONS
PANEL ON THE BACK OF THE ARRAY

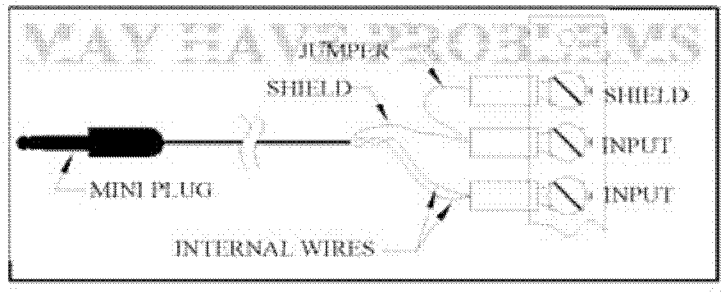


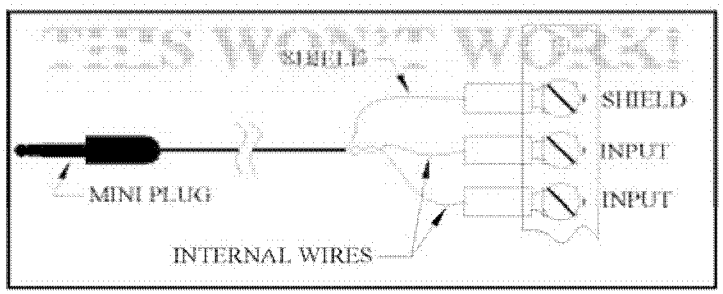
CONNECTING TO AUDIO SOURCES:

The input was designed to accept a wide range of audio sources, from balanced line-level professional boxes to unbalanced consumer equipment such as DVDs, CDs, AND MP3 players. Connecting unbalanced sources to the balanced input on the array can be a tricky. If you are in doubt, we have ready-made cord assemblies available at a reasonable price.

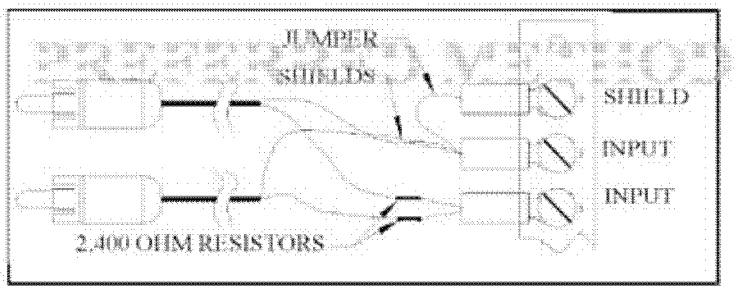
1/8" MINI-PLUG

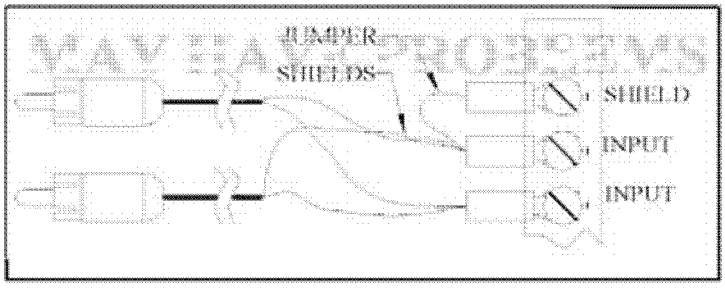


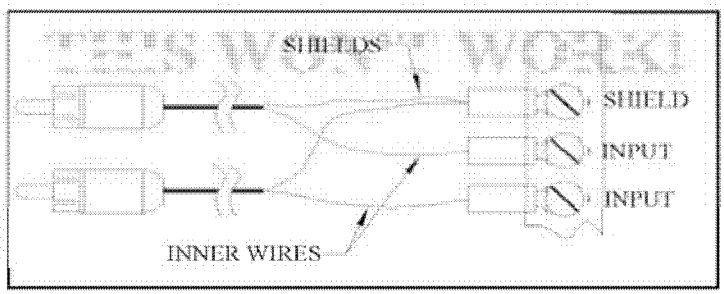




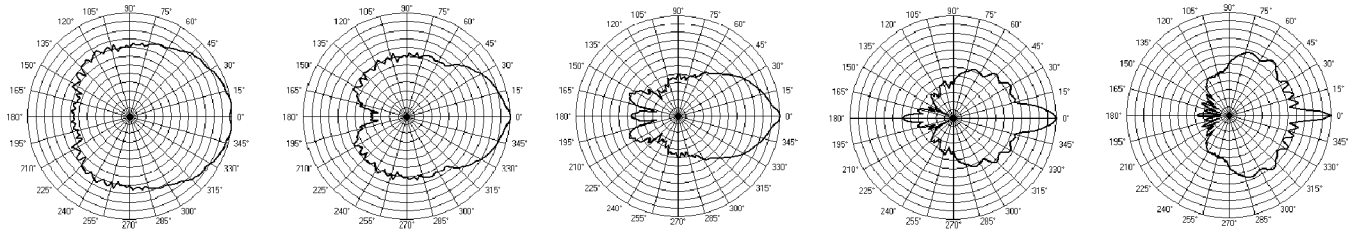
PHONO (RCA) PLUG





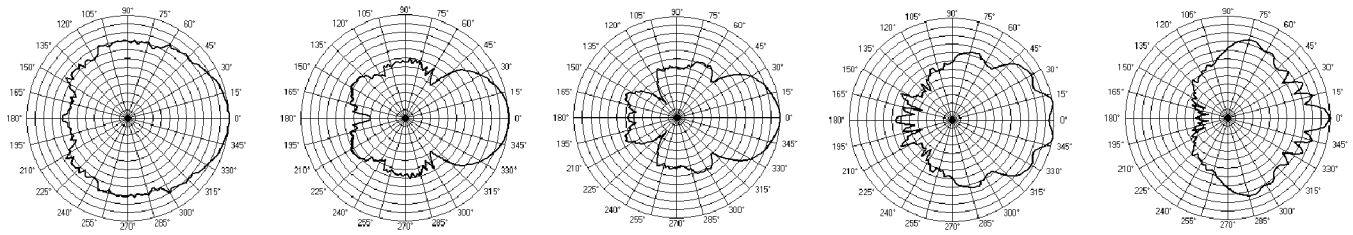


POLAR PATTERNS



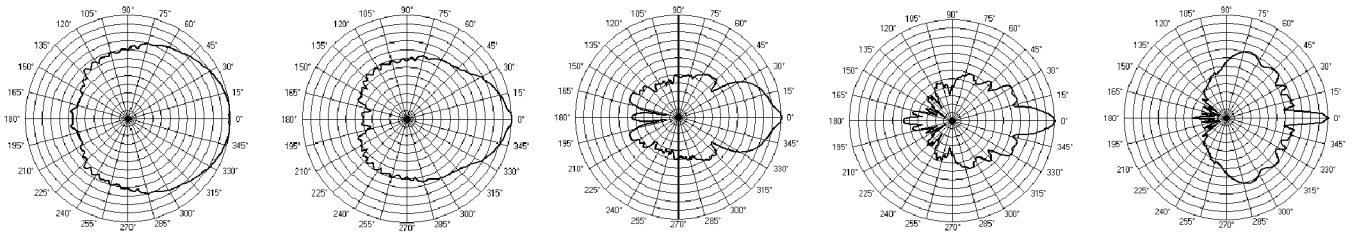
250 HZ 500 HZ 1 KHZ 2 KHZ 4 KHZ

SET AT 10' HEIGHT, NARROWEST PATTERN.



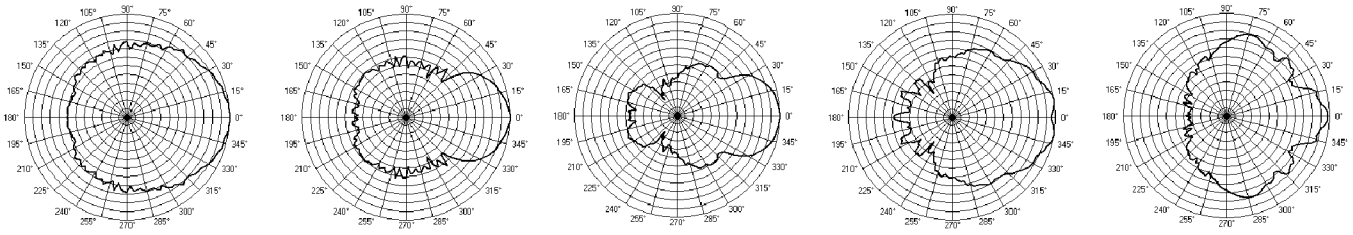
250 HZ 500 HZ 1 KHZ 2 KHZ 4 KHZ

SET AT 10' HEIGHT, WIDEST PATTERN.



250 HZ 500 HZ 1 KHZ 2 KHZ 4 KHZ

SET AT 14' HEIGHT, NARROWEST PATTERN.

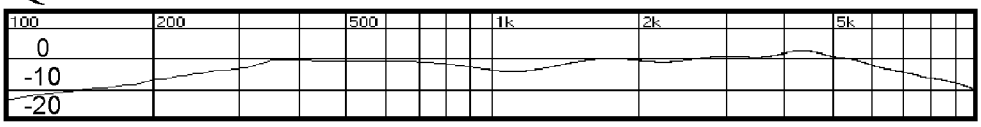


250 HZ 500 HZ 1 KHZ 2 KHZ 4 KHZ

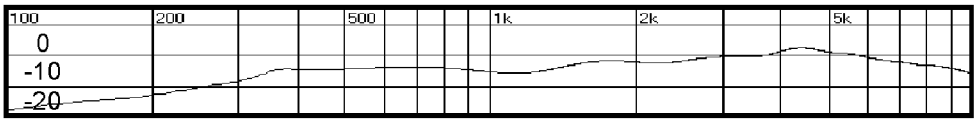
SET AT 14' HEIGHT, WIDEST PATTERN.

FREQUENCY RESPONSE

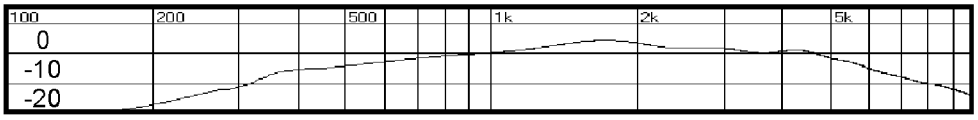
EQ SWITCH - MUSIC



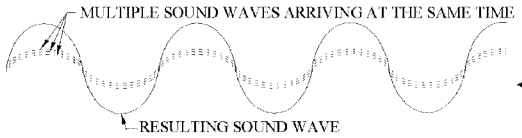
EQ SWITCH - VOICE W/MUSIC



EQ SWITCH - VOICE

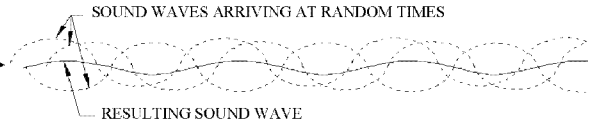


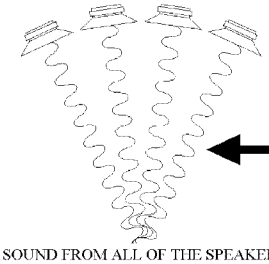
HOW DOES IT WORK?



If two or more sound waves arrive at the same place at the same time, they add and produce a sound wave that is the sum of all of the incoming sound waves.

When multiple sound waves arrive at random times, some waves cancel, producing a sound wave that is less than the sum of the incoming waves.

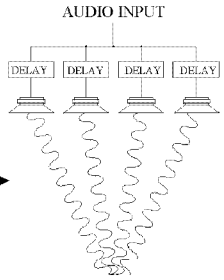




If several speakers are mounted equal distance from the listener, the sound from each of the speakers arrives at the listener's ears at the same time. The resulting sound is considerably louder than the sound from each individual speaker.

SOUND FROM ALL OF THE SPEAKERS ARRIVES AT THIS POINT SIMULTANEOUSLY

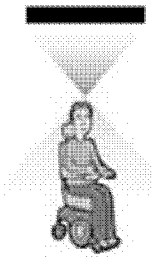
While it wouldn't be practical to mount the speakers in a spherical array (and the result would not be adjustable), we can achieve the same results by delaying the launch time from the speakers.



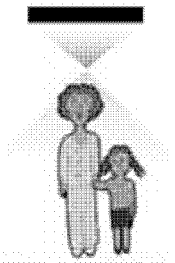
SOUND FROM ALL OF THE SPEAKERS ARRIVES AT THIS POINT SIMULTANEOUSLY

FOCUSED SOUND BY DAKOTA AUDIO

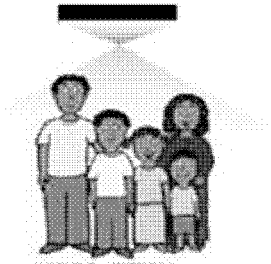
LOOKS BETTER, SOUNDS BETTER, WORKS BETTER
AND IT'S ADJUSTABLE.



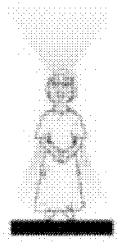
TIGHT PATTERN
FOR A SINGLE PERSON



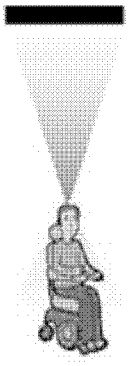
NORMAL PATTERN
FOR A PAIR OF LISTENERS



WIDE PATTERN
FOR A SMALL GROUP



IN THE FLOOR
UNDER THE LISTENER



THE ARRAY MOUNTING HEIGHT
IS ADJUSTABLE FROM
EIGHT TO 14 FEET

Dakota Audio Inc.
1815 Michigan Ave.
Bismarck, ND 58504

FOCUS enhancements

MANTIS

Mantis MC

Mantis MG

Applications

Command and Control
Events and Entertainment
Financial Services
Healthcare
Hospitality
Narrowcasting
Retail
Transportation

The Mantis line of digital media players from Focus Enhancements offers multiple channels of standard- or high-definition video and 32-bit graphics. Mantis players enable you to deliver a wide range of digital signage applications across numerous locations, and they provide the power to support the most creative and cutting-edge digital communication media elements.

Mantis Digital Media Players

Free of network hang-ups and capacity limitations, Mantis digital media players take the worry out of loading high-definition video through standard IT networks. Media is transferred to your Mantis player using the built-in DVD drive, an external hard drive, or a 10/100 network connection. Powered by the Focus Gemini 2 Universal Media Card(s), Mantis decodes all 18 ATSC formats to the resolution of your choice (up to 1080i), supports 4:3 and 16:9 aspect ratios, and provides precise A/V synchronization using hardware-enabled Dolby Digital™ decoding. Mantis MG supports customizable, multiple-monitor installations with fully scalable SD- and HD-channel synchronization. With cross-channel synchronization, video and audio are synchronized across numerous monitors, making it possible to create large-scale, wall-style video displays.

Whether you're managing a large-scale digital media network or individual players, Focus has a solution for you. For a digital media network that spans multiple locations, combine Mantis with DART Network Media Management Software (optional) and you can manage thousands of channels, complete with the precision needed to deliver specific content to specific displays at the right time. If you need precise time/date scheduling and automated, unattended playback on a smaller scale, Media Messenger® Remote Media Management Software (optional) is perfect for the job. If you're managing individual players, WebView™ (included) enables you to set up, monitor, and control individual players with ease.

Models

Mantis digital media players are available in two models—the Mantis MC Multi-Channel HD Media Player and the Mantis MG Enterprise Media Gateway.

Key Features

MODEL	Mantis MC	Mantis MG
Key Features		
32-bit Graphics	•	•
Broadcast-Quality Conversion Scaling (Up and Down)	•	•
Satellite Multicast	•	•
Scheduled Playback	•	•
Interactive Playback	•	•
Channels (Maximum)	2 HD or 2 SD	4 HD or 8 SD
Video		
Outputs: Composite, Component, or RGBHV	•	•
Decoding (MPEG Layers I, II)	•	•
Audio Outputs		
S/PDIF, Dolby Digital, Analog	•	•
Audio Decoding (MPEG Layers I, II, III)	•	•

FOCUS enhancements

MANTIS

Support

When you purchase digital signage solutions from Focus Enhancements, you not only receive reliable products that deliver superior performance every day, you also receive unconditional service and support from a team of seasoned video professionals. All products are backed by comprehensive warranties and optional support contracts that cover installation, training, 24/7 phone support, and priority parts replacement.

Consultation

With extensive experience in designing, configuring, and integrating digital signage solutions for leading organizations around the world, the Focus team can help you select the right products for your needs. If you have special requirements, solution consultation and custom configuration services are available.

Technical Specifications

MODELS	Mantis MC	Mantis MG
Base System	Gemini 2 Universal Media Card SmartCard	Gemini 2 Universal Media Card SmartCard 4-slot AV I/O expansion chassis
Disk	120GB	160GB or 500GB
Optical Drive	CD/DVD	CD/DVD
Expansion Options	—	Gemini 2 (2-channel) 8-VSB digital RF output, simultaneous NTSC/PAL outputs
Network	Compatible with the Linksys™ USB 200M EtherFast USB 2.0 10/100 Network Adapter; Integrated KenCast FAZZT client (option) or integrated Skystream zBand® client (option); FTP and HTTP auto-updating; USB dial-up modem support; Ethernet (10/100 Mbps)	
Serial and Ethernet Control	AMX, Leightronix, Crestron, Contemporary Research certified; Visual Circuits and LDP protocol libraries	
Video Outputs	Composite, Component, or RGBHV (Component or RGBHV via DB15 connector with VGA cable)	
Video Decoding	MPEG-2 unencrypted DVD (.vob) files: Decodes main profile at main level and main profile at high level; MPEG-2 streams (ISO 13818-1): Decodes transport, program streams, and elementary streams; decodes all 18 ATSC formats up to 1920 x 1080p; data rate up to 45 Mbps; 16:9, 4:3, 5:4 aspect ratios; 4:2:0 decoding	
Audio	Stereo or Dolby Digital via S/PDIF, stereo analog, MPEG Layers I, II, III	
Software	DART Network Media Management Software: For developing and managing a large-scale, in-store digital media network (optional) Media Messenger Remote Media Management Software: For managing and distributing media via FTP or HTTP to single or multiple Mantis servers (optional) WebView: HTML-based setup, monitor, and control interface; requires Internet Explorer 5.5 or higher (included)	
Physical	4.45 cm (1.75") high (1RU) x 43 cm (17") wide x 41 cm (16") deep	13.34 cm (5.25") high (3RU) x 43.18 cm (17") wide x 43.82 cm (17.25") deep
Weight	Approximately 5.5 kg (12 lbs.)	Approximately 6.8 kg (15 lbs.)
Power	100–240V AC, 50/60 Hz; 60 watts average	100–240V AC, 50/60 Hz; 90 watts average
Temperature Range	0°–40° Celsius continuous operation (0°–65° C short-term)	0°–40° Celsius continuous operation (0°–65° C short-term)
Certification	FCC Part 15, Class A; CE	FCC Part 15, Class A; CE

Corporate Headquarters

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GORILLA AUDIO HANDSET

Works with any A/V system

"It's a Headphone on a Stick"

- Ideal for:
  - Video Soundtracks
  - Computer Kiosks
  - Trade Shows
  - Museum Exhibits
  - Theaters

- Fulfills ADA Requirements
- Maintenance Free
- Easy To Clean
- Works with Video and Audio Players, DVDs, CD Audio
- Superior Fidelity
- Ant-Theft Security Lanyard
- Simple Installation
- Hearing-Aid Compatible
- Multiple Colors Available

The Gorilla Audio Handset from Stop and Listen is precision engineered to complete virtually any audio or video playback system. In front of a video monitor, at a computer kiosk, or at an audio listening station, it's the perfect choice. It works well with anything with a soundtrack or an audio output.

Multiple handsets? The simple 2-wire interface makes installation easy, even for large theaters and gatherings needing several units. The versatile design can be customized to fit any application.

When regular speakers just can't do the job, the Gorilla Audio Handset from Stop and Listen it gets the message across - plain and simple.

MAKING AUDIO EASY...

STOP & LISTEN

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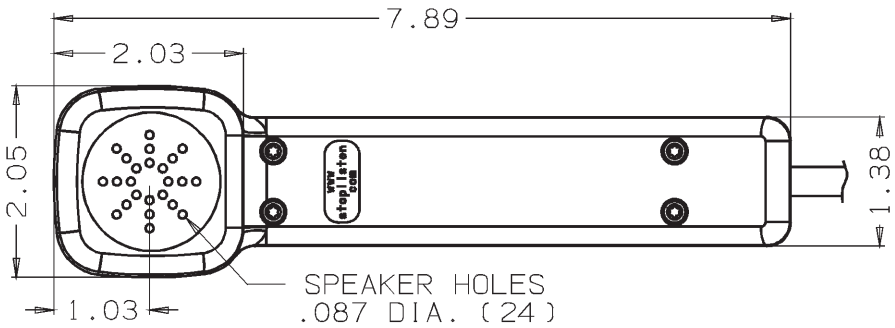
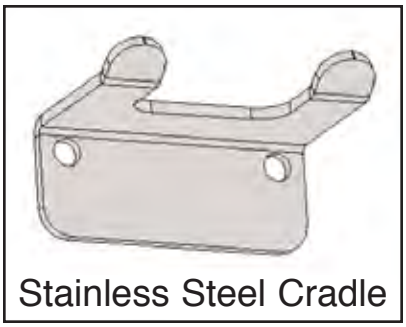
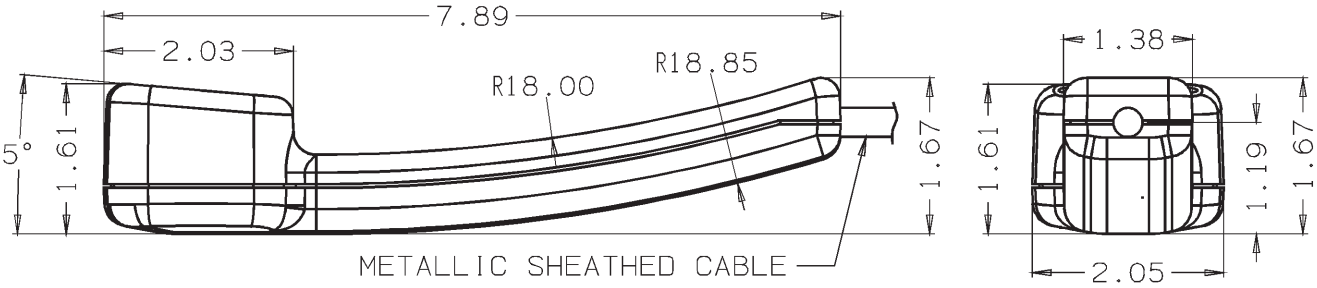
DETAILED SPECIFICATIONS ON REVERSE

The Gorilla Audio Handset

Technical Specifications







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- Full Frequency Response 50Hz - 20KHz
- 32 Ohm Input Impedance
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- Hygienic and Easy to Clean
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- Simple Two Wire Connection
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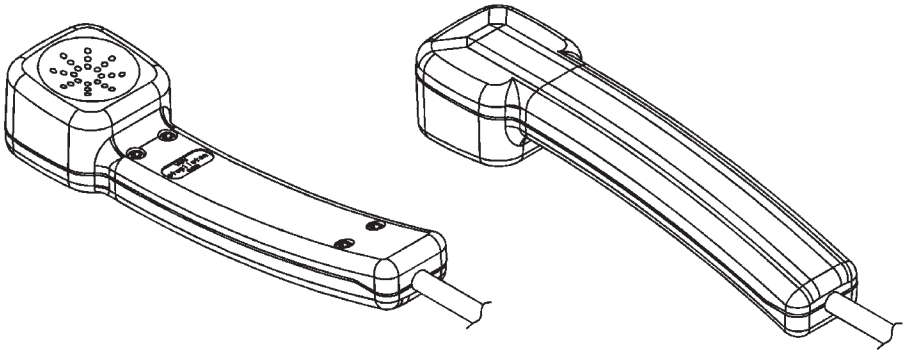
- Neodymium Iron Boron (NdFeB) Magnet
- 500 lb. Aircraft Steel Anti-theft Lanyard
- Water Resistant Materials/Construction
- Hearing Aid Compatible / ADA

Available In A Variety of Colors



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HP ProtectTools™ security software suite delivers an assortment of hardware and software tools, he demands.

Integrated TPM 1.2

Additional accessories

- [ ] **GW286AV** HP FireWire IEEE 1394 PCI Card (De-selection of parallel port may be required to add this
- [ ] **AJ406AV** 2nd serial port adapter (This module is not allowed if all of the PCI and PCIe slots are full. De
- [ ] **GQ179AV#ABA** Welcome Center SMB Offers (Available only w/Vista OS) [Add $2.00]
- [x] **AJ407AV** HP Parallel Port Adapter (This module is not allowed if all of the PCI and PCIe slots are full)
- [ ] **GH590AV** HP Total Care Advisor (Available only if Vista Business 32 or Vista Home Basic OS is select
- [ ] **GW285AV** 1GB Flash Module for ReadyBoost (Available only w/Vista OS; available only w/512MB or 1
- [ ] **KU660AV** McAfee Total Protection - Small Business [Add $2.00]
- [ ] **KU901AV** HP Thin USB Powered Speakers (Not available w/Symantec Anti-virus) [Add $12.00]

Restore CD

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3-year (parts/labor/next business day on-site) limited warranty - MT

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Warranty and Service Upgrades (for 4-year warranty selection)

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Warranty and Service Upgrades (for 5-year warranty selection)

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Basic installation services

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Software services

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Desktop Printers

- ☐ **CC567A#ABA** HP Photosmart C7280 all-in-one [Add $269.99]
- ☐ **C8189A#ABA** HP Officejet Pro L7680 color all-in-one [Add $279.00]

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Bundles (not factory installed)

- ☐ **RT174AT** Bundle Promo, Connectivity Starter Kit - Surge Protector/LAN cable/Printer cable [Add $20.0

- ☐ **KF885AT** Promo - USB Mouse/Keyboard Kit [Add $29.00]
- ☐ **KF886AT** Promo - HP PS/2 Mouse/Keyboard Kit [Add $29.00]
- ☐ **RT174AA** Bundle, Connectivity Starter Kit - Surge Protector/LAN cable/Printer cable [Add $29.00]

Adapters and Cables (not factory installed)

- [ ] **EM449AA** Belkin USB to Serial Adapter [Add $20.00]
- [ ] **AH122AA** Belkin 14 ft Cat5e Patch Cable [Add $5.50]
- [ ] **AH123AA** Belkin 6 ft Firewire (1394) Cable [Add $10.00]
- [ ] **PA997A** HP FireWire / IEEE 1394 PCI Card [Add $39.00]

Multimedia and Audio Devices (not factory installed)

- [ ] **KK912AA** Thin USB Powered Speakers [Add $29.00]

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- [ ] **EH352AA** Intel Pro 1000 PT Gb Ethernet PCIe NIC [Add $49.00]
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Chassis Accessories (not factory installed)

- [ ] **PA716A** HP 2nd Serial Port Adapter [Add $25.00]
- [ ] **DC177B** HP 5.25" Blank Bezel Kit (Carbonite 50/Bulk Pack) [Add $49.00]
- [ ] **KD061AA** Parallel Port Adapter [Add $25.00]

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- [ ] **AG290AA#ABA** Belkin 7-outlet Surge Protector [Add $19.00]
- [ ] **AF403A** HP T1000 5-15P NA USB Serial UPS [Add $395.00]
- [ ] **378439-D71** HP T750 Low Voltage NA/JP UPS [Add $289.00]
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- [ ] **BB731UT** HP Smart Data Protection Service - Smart Buy Promotional Sku [Add $119.00]

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Control® 25

Compact Indoor/Outdoor Background/Foreground Speaker

Professional Series

Key Features:

- Components: 5¼" Polypropylene coated woofer, ¾" Titanium coated horn loaded tweeter.
- Built-in *InvisiBall*® mounting hardware
- Weather resistant enclosure and transducers
- Readily paintable
- 90° x 90° high frequency horn
- Overload Protection Circuitry
- Sensitivity: 88 dB SPL, 1W, 1m

The Control 25 is perhaps the most versatile of JBL Professional's Control Contractor Series indoor/outdoor loudspeakers. Its robust nature makes the Control 25 a perfect choice for restaurants, health clubs, outdoor theme and water parks or other applications where foreground/background music and paging are required.

The unique *InvisiBall*® mounting hardware is included in each system and makes short work of permanent installation. The *InvisiBall* mounting method adds the benefit of vertical rotation of up to 37° off-axis and horizontal rotation of up to 44° off-axis. Because *InvisiBall* adjustments are made through a hidden access behind the logo badge, the grill never needs to be removed and there exists a high degree of theft deterrence as well.

The Control 25 readily accepts a variety of paints and finishes to match any decor.

Weather resistance is maximized by coating the woofer cone in polypropylene and terminating its circumference in JBL's *WeatherEdge*™, a seamless, rubberized extension of the woofer surround that provides added protection to critical transducer elements. The polycarbonate tweeter diaphragm is reinforced with a thin film of titanium for added rigidity and endurance against sun, salt and moisture. Zinc plated grilles resist rusting in the harshest conditions.

Available in black (Control 25) and white (Control 25-WH).

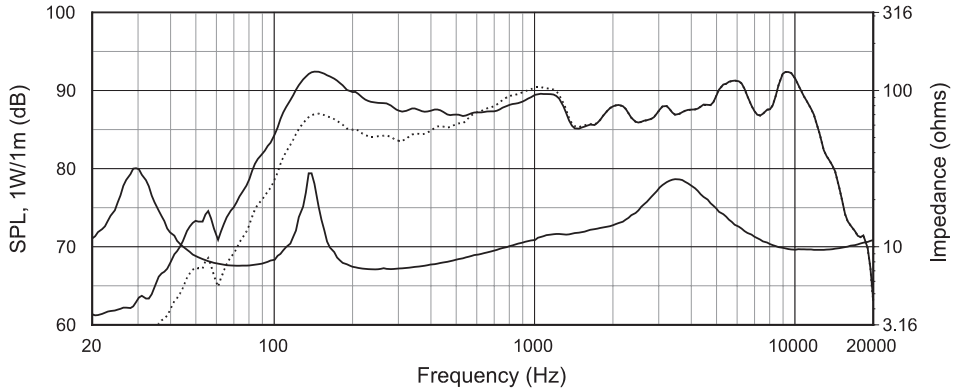
Specifications:

Frequency Range (-10 dB)[1]:	80 Hz to 16 kHz
Continuous Program Power Capacity[2]:	150 Watts
Sensitivity[3]:	88 dB SPL, 1W, 1m
Directivity Factor (Q):	5.3
Directivity Index (DI):	7.2
Nominal Impedance:	8 ohms
Crossover Frequency:	3.0 kHz
Nominal Coverage:	90° x 90°
LF Driver:	135 mm (5.25 in) Polypropylene coated paper w/WeatherEdge
HF Driver:	19 mm (.75 in) Titanium coated polycarbonate
Enclosure Material:	HIPS (High Impact Polystyrene)
Overload Protection:	Full-Range power limiting to protect network and transducers
Termination:	Spring terminals, accepts banana plug
Environmental:	Conforms to Mil Spec 810 for humidity, salt spray, temperature & UV. IEC 529 IP-X4 splashproof rating.
Dimensions (H x W x D):	236 x 188 x 149 mm (9.3 x 7.4 x 5.8 in)
Net Weight (ea):	2.3 kg (5 lbs)
Shipping Weight (pr):	5 kg (11 lbs)
Included Accessories:	Invisiball Assembly 6 mm x 100 mm hex key
Optional Accessories:	
MTC-25V:	For vertical columnar orientation of up to 3 loudspeakers
MTC-25/23H:	For horizontal splaying of two speakers. Three brackets array up to six loudspeakers in a 360° array.
MTC-28/25CM:	Ceiling-mount adapter.
MTC-25SSG:	Stainless Steel Grille for harsh environments. Available in silver, black (-BK) or white (-WH)
MTC-25WMG:	WeatherMax™ Stainless Steel Grille protects against driving precipitation. Available in black or white (-WH)
MTC-PC2:	Input panel cover protects input terminals in outdoor environments

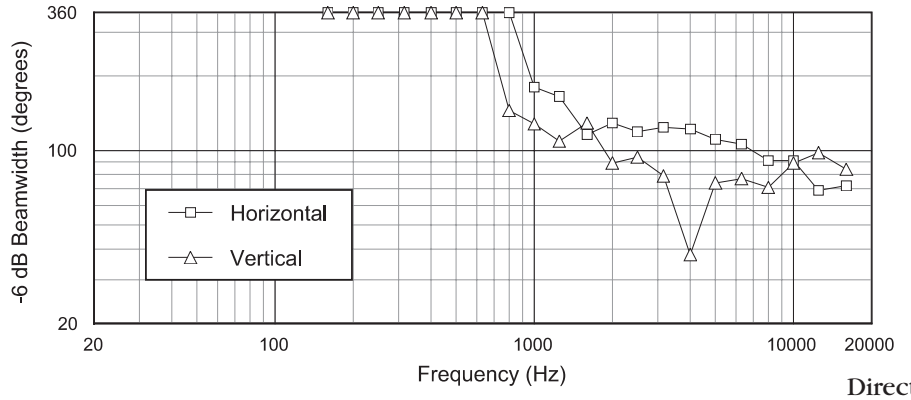
[1]Half-space (on-wall).
[2]Continuous program power is a conservative expression of the system's ability to handle normal speech and music program material and is defined as 3 dB above the Continuous Pink Noise Rating (IEC-shaped pink noise with a 6 dB crest factor, for 100 hours continuously).
[3]Half-space (on-wall), ave 100 Hz to 10 kHz.

JBL continually engages in research related to product improvement. Changes introduced into existing products without notice are an expression of that philosophy.

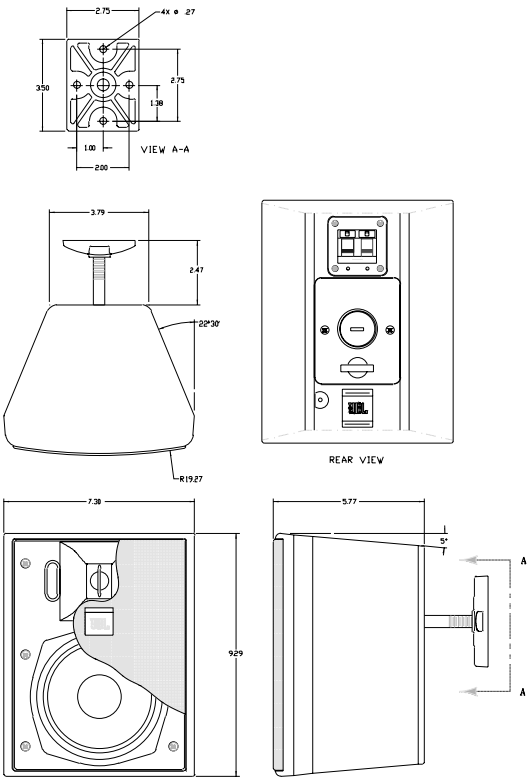
Control® 25 Compact Indoor/Outdoor Background/Foreground Speaker



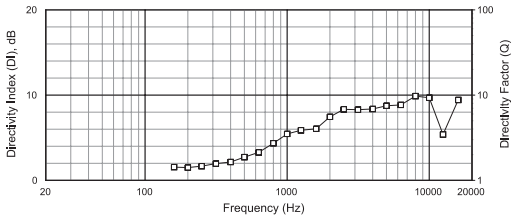
Frequency Response in half-space (2π, solid line) and full-space (4π, dotted line), and Input Impedance



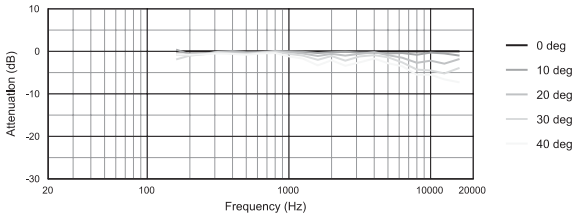
Beamwidth



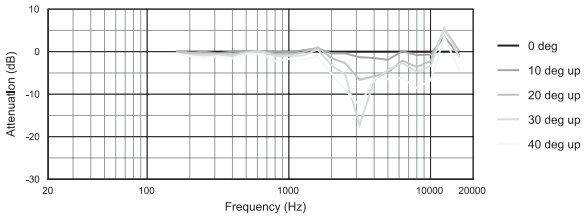
Directivity Index, Q



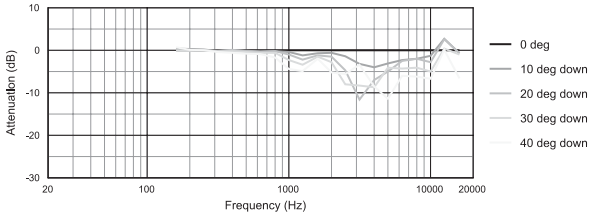
Horizontal Off Axis Frequency Response



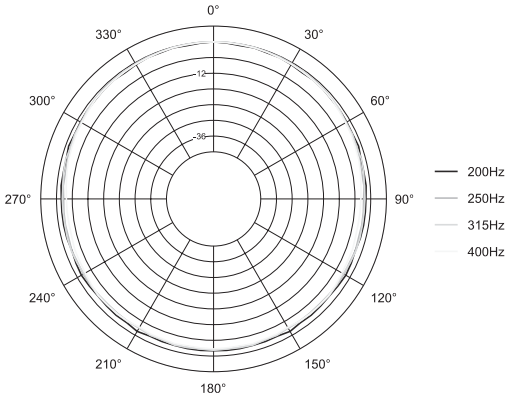
Vertical Off Axis Frequency Response (up)

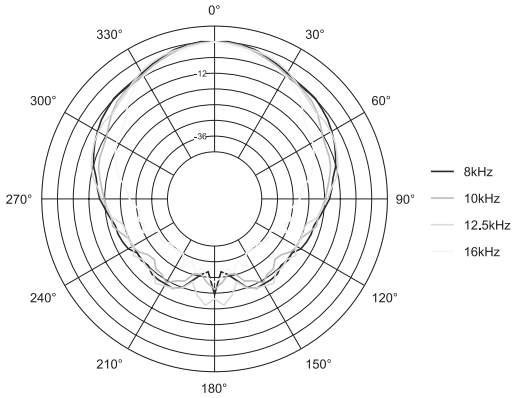


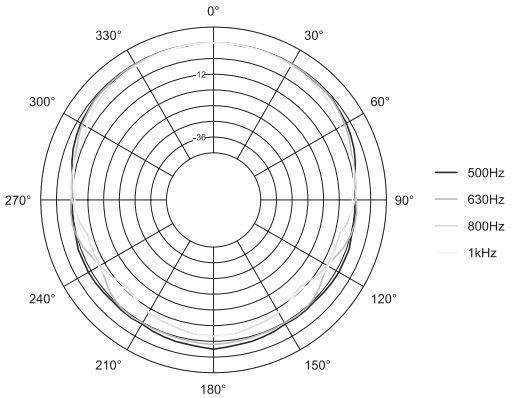
Vertical Off Axis Frequency Response (down)

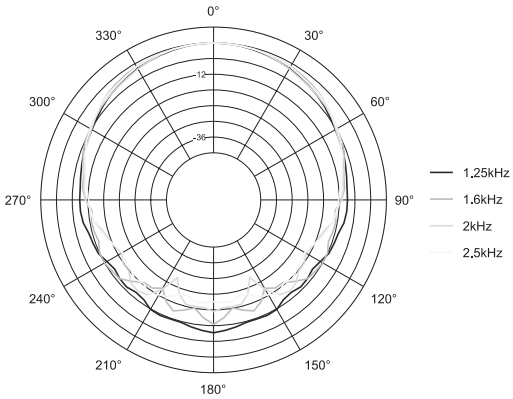


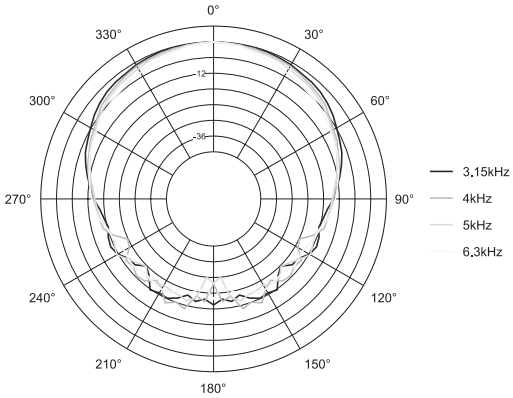
Horizontal 1/3 Octave Polars











Architectural Specifications:

The loudspeaker shall consist of a 135 mm (5-1/4 in) low frequency transducer, 19 mm (3/4 in) high frequency transducer, and frequency dividing network installed in a ported enclosure. The low frequency voice coil shall be 25 mm (1 in) in diameter.

Performance specifications of a typical production unit shall be as follows: Measured sensitivity (SPL at 1 m [3.3ft] with 2.83V input, averaged from 500 Hz to 1.5 kHz) shall be at least 88 dB-SPL. Usable frequency response shall extend from 80 Hz to 16 kHz (10 dB below rated sensitivity, in half-space, with no external equalization). Nominal impedance shall be 8 ohms. The frequency dividing network shall have a crossover frequency of 3.0 kHz. Rated power capacity shall be at least 150 watts continuous program power, defined as 3 dB above a test signal of filtered random noise conforming to international standard IEC268-5 (shaped pink noise with a peak-to-average ratio of 6 dB), for 100 continuous hours duration.

The system shall be protected against damage from occassional overpowering via full range series lamps that limits the power to the network and transducers. The high frequency transducer shall be horn-loaded to more evenly cover a nominal 90° horizontal by 90° vertical area.

The enclosure shall be constructed of high-impact polystyrene for protection against the elements in outdoor applications, and for paintability. The grille shall be completely zinc-coated for resistance against rusting, shall be bake-painted black, and shall be secured via screws to keep it in place when facing downward.

The low frequency transducer shall have a polypropelene-coated cone and a butyl rubber surround which shall extend seamlessly over the edge of the speaker frame for protection against the elements. The high frequency transducer shall be constructed of polycarbonate, reinforced with a titanium film for additional weather resistance. The system shall withstand Mil Spec 810 testing with specified time durations for exposure to the following environments with no effect on its acoustical performance or structural integrity: salt spray (method 509.3), temperature -19°C to 49°C (method 501.3 and 502.3), 95% humidity (method 507.3) and ultra-violet (method 505.3). The system shall have a IEC 529 splashproof rating of IP-X4.

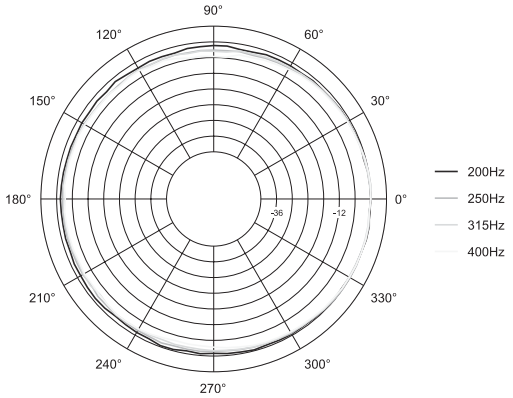
For theft deterrence, the installation access area shall be hidden behind a snap-out cover, and the access area shall be on the front of the loudspeaker for ease of installation and adjustment. The loudspeaker shall be rotatable over a minimum of ±35° in all directions via a ball-type mounting system. The ball mechanism shall be internal to the cabinet to allow low-profile mounting and better stability via a short moment arm. The logo shall be rotatable for proper orientation when the loudspeaker is mounted horizontally or vertically.

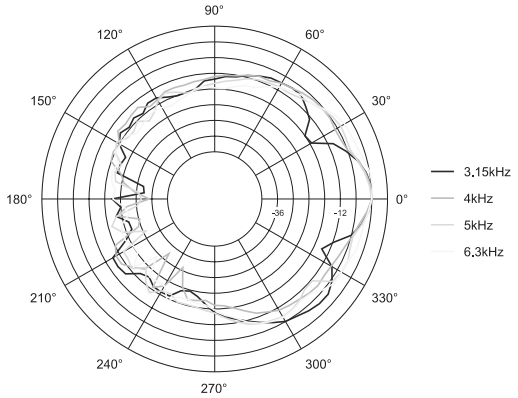
The external wiring connectors shall be spring loaded and gold plated, and shall accept bare wire, single or dual banana-type connectors with 19 mm (3/4 in) spacing. Overall cabinet dimensions shall be no greater than 236 mm (9.3 in) high by 188 mm (7.4 in) wide by 148 mm (5.8 in) deep and shall weigh no more than 2.3 kg (5 lbs).
The finish shall be a paintable lighly textured black.

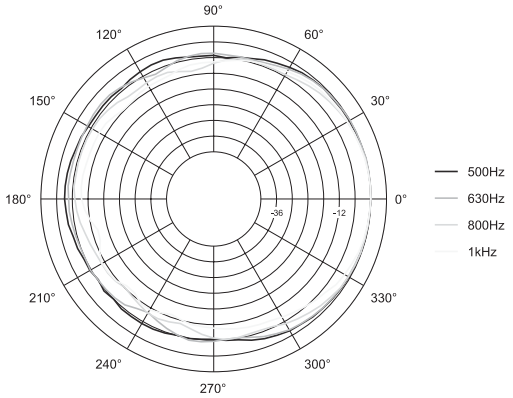
The system shall be the JBL Model Control 25 with included Invisiball® mounting system.

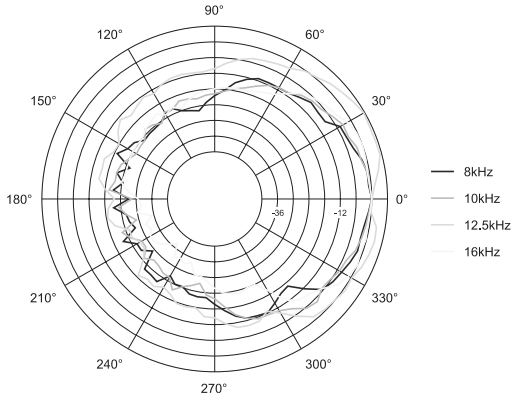
Control® 25 Compact Indoor/Outdoor Background/Foreground Speaker

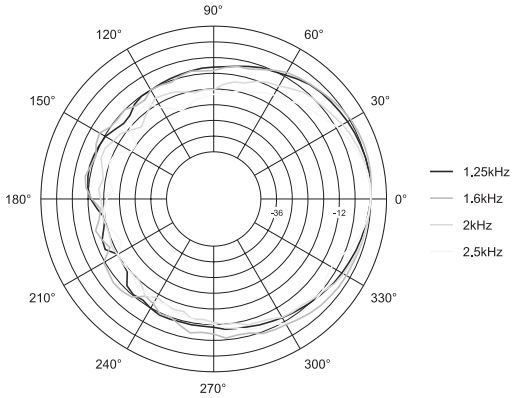
Vertical 1/3 Octave Polars











JBL Professional
8500 Balboa Boulevard, P.O. Box 2200
Northridge, California 91329 U.S.A.
A Harman International Company

SS Control 25
CRP 10M
12/00

Artisan Series

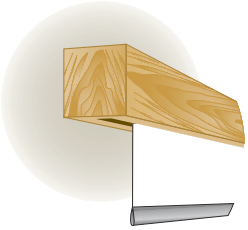
The beauty and grace of hand-rubbed hardwood or the spare modern lines of plastic laminate. Craftsmanship to complement the finest furnishings.

Artisan Series projection screens complement the fine furniture in your conference room. They are enclosed in solid hardwood cases with a variety of finishes to match virtually any decor—or in sleek, contemporary plastic laminate.

Artisan/Series V—Motorized screen features Draper's Tab Tensioning System, with choice of M1300, M2500 or HiDef Grey viewing surface. 12″ of black drop at top of screen is standard with Series V.

Artisan/Series E—Motorized screen with your choice of a conventional viewing surface: Matt White, Glass Beaded or High Contrast Grey.

Artisan/Series M—Manual, spring-roller operated screen with your choice of a viewing surface: Matt White, Glass Beaded or High Contrast Grey.

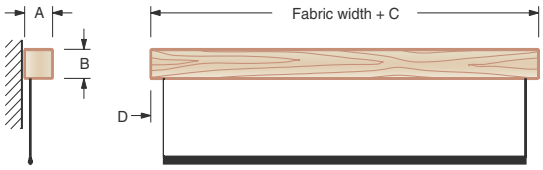


Artisan installation at Sidley Austin LLP, Chicago, IL. Photography: © Barry Rustin, Evanston, IL.

System Options

- *Case Styles*—Hardwood cases are available in four styles: Rectilinear, radius, bevel or traditional. See samples on this page.
- *Case Finishes*—Choose from seven hardwoods and five laminates. Custom finishes are available. See samples on this page (actual finish may vary from photos; samples are available upon request).
- *Extra Drop*— Additional drop optional, either surface color or black. (Black is standard for Series V. Surface color is standard for Series E and M in AV format; black in other formats.)
- *Black Masking Borders*—Borders are optional for Series E and M in AV format. They are standard for all Series V screens, and for Series E and M in all other formats.
- *Control Options*—Refer to page 4.

Case Dimensions



	A	B*	C	D
Series E	5″	5¼″	12″	6″
Series M				
Through 70″ x 70″	3½″	3½″	3″	1½″
Over 70″ x 70″	4¼″	4¼″	4″	2″
Series V	6″	6⅜″	–Variable–	

*Add 1⅛″ to height if case is to be bevel style.

Case Styles and Finishes

Radius ***Rectilinear*** ***Traditional*** ***Bevel***

Solid Hardwoods

Natural Maple

Natural Cherry

Light Oak

Medium Oak

Walnut

Medium Cherry

Mahogany

Plastic Laminates

White

Black

Beige

Dove Grey

Burgundy

Dimensions & Data—Artisan Series

	Size H x W	Series M Case Length	Series M Net Wt. (lbs.)	Series E Case Length	Series E Net Wt. (lbs.)	Series V Case Length*	Series V Dowel Length*	Series V Net Wt. (lbs.)
AV Format	50″ x 50″	53″	17	64″	50	73⅝″	60″	55
	60″ x 60″	63″	19	72″	55	84⅜″	71″	60
	70″ x 70″	73″	21	82″	60	94⅝″	82″	70
	84″ x 84″	88″	39	96″	75	109⅞″	84″	80
	72″ x 96″	100″	42	108″	80	120⅝″	96″	85
	96″ x 96″	100″	43	108″	85	123⅜″	109½″	90

Nominal Diagonal	Image Area H x W	Series M Case Length	Series M Net Wt. (lbs.)	Series E Case Length	Series E Net Wt. (lbs.)	Image Area H x W	Series V Case Length*	Series V Dowel Length*	Series V Net Wt. (lbs.)
NTSC Video Format (4:3)									
6′	42½″ x 56½″	63″	19	72″	55	42½″ x 56½″	79⅝″	66½″	60
7′	50″ x 66½″	73″	21	82″	60	50″ x 66½″	89⅞″	76½″	70
100″	60″ x 80″	88″	33	96″	70	60″ x 80″	105⅜″	91″	80
10′	69″ x 92″	100″	38	108″	80	72″ x 96″	120⅝″	108″	85
HDTV Format (16:9)									
92″	45″ x 80″	88″	33	96″	70	45″ x 80″	103⅛″	90″	80
106 ″	52″ x 92″	100″	38	108″	80	52″ x 92″	115⅝″	102″	85

*Additional drop will increase the overall case and dowel length for Series V. See page 21 for Artisan Method of Installation.

NEC MultiSync® 15 Series

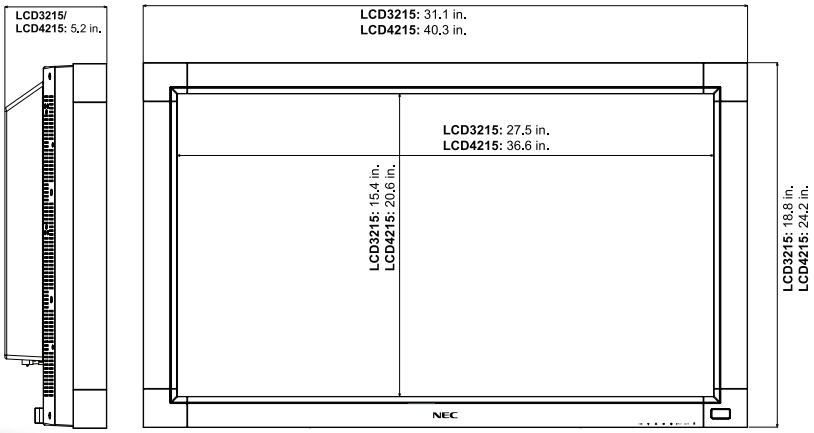
32″ and 42″ commercial-grade LCD displays ideal for digital signage applications

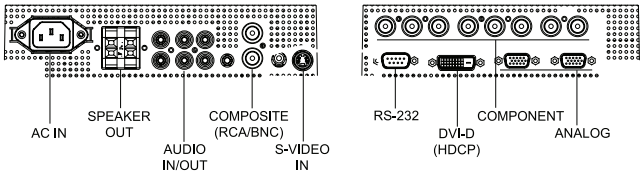
Maximize your messaging without having to maximize your budget. The NEC MultiSync 15 Series, featuring the 32″ NEC LCD3215 and 42″ NEC LCD4215, provides a cost-conscious solution for your digital signage applications. Their high-performance panel and abundance of advanced technologies that promote extended use, along with an adaptable mechanical design, make these displays ideal for a wide variety of environments. Drive foot traffic and sales in retail stores. Whet appetites in restaurants. Build brand awareness and turn heads during presentations in corporate lobbies and boardrooms. With the MultiSync 15 Series, you can create dynamic digital signage solutions in virtually any space and achieve your business goals.

- **Commercial-grade design** lead to the displays' extended use for various applications
- **Public-display-grade panel** protects against permanent image retention
- **Comprehensive input panel** connects you to the latest peripherals
- **500 cd/m² brightness and 800:1 contrast ratio** help create eye-catching images and crisp, easy-to-read text
- **Protective-glass and touch-panel ready design** provide opportunities for module protection and interactivity
- **TileMatrix**™ allows you to create video walls (up to 16 displays in a 4x4 matrix equalling 12 ft. diagonal)
- **TileComp**™ works in tandem with TileMatrix to compensate for the bezel width and create a more seamless video wall
- **Landscape and portrait orientations** allow for flexible content placement, maximizing audience awareness
- **RS-232 input with diagnostics** provides high-quality serial control
- **Scheduler with round-the-clock feature** allows for 7-day scheduling of content and powering of the display

Specifications for LCD3215/LCD4215

MODEL	LCD3215	LCD4215
LCD MODULE		
Viewable Size (Diagonal)	32″	42″
Panel Technology	S-IPS	
Native Resolution	1366 x 768	
Pixel Pitch	0.511mm	0.681mm
Brightness (Typical)	500 cd/m²	
Contrast Ratio (Typical)	800:1	
Active Screen Area (W x H)	27.5 x 15.4 in. / 697.7 x 372.3mm	36.6 x 20.6 in. / 930.2 x 523mm
CONNECTIVITY		
Input Terminals		
RGB1 (Digital)	DVI-D 24 pin (HDCP)	
RGB2 (Analog)	15-pin D-sub	
RGB3 (Analog)	5 BNC (RGBHV)	
Video 1	Composite (Shared RCA and BNC)	
Video 2	S-Video	
DVD/HD Video 1	Component BNC (Y,Cb/Pb, Cr/Pr)	
Audio	RCA (L/R) x 2: Stereo MiniJack + external speaker jacks	
Output Terminals		
RGB	Yes	
Video	Yes	
Audio	Yes	
Audio Amplifier	7W Stereo	
External Control	RS-232, IR, DDC/CI	
FEATURES		
Additional Features	Advanced cooling system for long operation; Intelligent Power Management System; advanced self diagnostics with communication; portrait/landscape; TileMatrix (up to 16 displays); TileComp; screen saver; control key lock-out mode; complete scheduler; NaViSet; picture-in-picture (PIP); side-by-side (SBS)	
POWER		
Power Requirements	AC 100-240V@50/60 Hz	
Power Consumption (Typical)	120W	190W
Power Consumption (Standby Mode)	< 5W	
PHYSICAL SPECIFICATIONS		
Bezel Width (L/R, T/B)	1.7 in. / 1.6 in. , 44.2mm / 40.5mm	1.7 in. / 1.7 in. , 44.2mm / 43.3mm
Dimensions (without stand; WxHxD)	31.1 x 18.8 x 5.2 in. / 789 x 476.3 x 133mm	40.3 x 24.2 x 5.2 in. / 1022.9 x 613.5 x 133mm
Packaging Dimensions (WxHxD)	36.4 x 23.8 x 11 in. / 925 x 604 x 283mm	44.9 x 27.7 x 9.3 in. / 1140 x 703 x 237mm
Net Weight (without stand)	28.9 lbs. / 13.1 kg	47.6 lbs / 21.6 kg
Gross Weight (with box)	39 lbs. / 17.7 kg	59.5 lbs / 27 kg
VESA Hole Configuration	200 x 200mm (4 hole)	
ENVIRONMENTAL CONDITIONS		
Operating Temperature	5-40°C / 41-104°F	
Operating Humidity	20-80%	
ACCESSORIES		
Included	Power cord, 15-pin D-sub cable, user manual, setup sheet, wireless remote control, batteries, main power switch cover, CD-ROM	
Optional	External speakers (SP-3215), stand (ST-3215), tilt wall mount kit (WMK3260-L), Digital Signage Kit (DSK3260)	External speakers (SP4020-4620), stand (ST-4020), tilt wall mount kit (WMK3260-L), Digital Signage Kit (DSK3260)
WARRANTY/SERVICE		
On-Site Limited Warranty	3 years parts and labor, including backlight	





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866-NEC-MORE

NEC

ARC SCIENCE SIMULATIONS

Visualizing Natural Realities

www.arcscience.com

306 North Washington Street
Loveland, Colorado 80537
P 970.667.1168
F 970.667.1105

OmniGlobe Spherical Display System Cost Estimate

Prepared for: **Date:** April 11, 2008

Becky Menlove
Utah Museum of Natural History
1390 E. Presidents Circle
University of Utah
Salt Lake City, UT 84112-0050

The following is in response to a request for estimated costs for a spherical display exhibit.

Description	**Price**

32" Single Projector OmniGlobe Display System including:

1. 32" diameter screen with Enhanced Contrast screen treatment.
2. All required optical elements and alignment assemblies.
3. Cylindrical base projector enclosure and pedestal.
4. One Canon SXGA 4000 ANSI Lumens projector with lens.
5. Computer with high performance video.
6. Touch Screen monitor for viewer interactivity
7. OmniExplorer^{tm} presentation software and Geometer^{tm} conversion software.

System total hardware & Software cost: $42,000

Content Options

1. Rotating fully illuminated Earth with and without clouds	No Charge
2. 300 Million Year Paleo Animation for the 32" OmniGlobe	$3500
3. 600 Million Year Paleo Animation for the 32" OmniGlobe	$6500

Quoted Prices and Possible Adjustments

The above prices are quoted to the best of present knowledge, and are not expected to change for the deliverables as described. Future cost changes, over which ARC has no control, and possible changes/additions requested by the Museum, could require cost adjustments.

Validity

This pricing proposal is valid for 90 Days after the date listed at the top.

Delivery

8-12 Weeks after initial 33% down payment

www.arcscience.com
306 North Washington Street
Loveland, Colorado 80537
P 970.667.1168
F 970.667.1105

Project Schedule and Payment Terms

The project work will be initiated upon the signing of a Purchase Agreement at which time an advance payment to ARC will be due.

Agreement advance – (Upon signing)	33% due (initiates 8-12 week delivery schedule)
Shipment to Customer	33% due (Installation the following week)
Installation completed/operating	Balance due 15 days net upon acceptance

Installation & Training

The above quoted price includes installation labor and training on the hardware & software systems, but not shipping expenses or ARC travel & lodging expenses for one installation technician. These expenses will be invoiced separately after installation and acceptance.

Operation and Software Support

Upon installation, ARC will provide the necessary documentation and training to Client representatives for the normal operation of the display system and software. ARC will provide full Support for our OmniExplorer™ presentation software and Geometer™ conversion software as it relates to operation of the OmniGlobe as delivered but ARC may not be able to provide support for some Microsoft Windows® related issues. Periodic updates for OmniExplorer or Geometer may also be provided for free or for a minimal charge if significant upgrades in the functionality become available.

System Content

ARC Science Simulations was incorporated in 1981 as Applied Research & Consulting (ARC) and has been installing spherical display systems since 2002. The hallmark of ARC Science Simulations has been and remains a tight adherence to high aesthetic quality and good science. To the extent possible, our imagery and visualization creations present a picture that is well informed, interesting, and attractive. ARC has an extensive library of content already formatted for the OmniGlobe but will also provide support to others wanting to create their own content.

Warranty and Maintenance

The projector and computer are standard products covered by their respective manufacturer's warranties, generally 1-2 years parts and labor. ARC warrants the rest of the system, which is principally the screen and optics, for one year for problems or failures due to workmanship or materials, and which are not intentional or inadvertent damaging acts at the exhibit site.

OmniGlobe®

Panasonic
ideas for life

PT-D10000U
3-chip DLP® Projector

World's smallest* DLP® system projector with 10,000 lumens of brightness.

*As of December, 2006

10,000 lm

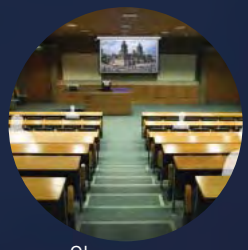
SXGA+

AUTO CLEANING ROBOT

PICTURE BY DLP TEXAS INSTRUMENTS

PT-D10000U

Projection of bright, high-quality images in large spaces.



Classrooms

Conference rooms

Theaters

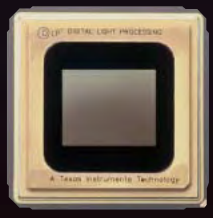
High brightness — 10,000-lumen

High contrast ratio — 5,000:1

High image quality — SXGA+

Outstanding 10,000-lumen brightness and superb image quality

Thanks to Panasonic's four lamp system, the new PT-D10000U delivers 10,000 lumens of brightness. And with Panasonic's dynamic iris technology, it achieves a super-high 5000:1 contrast ratio. Also featuring 3-chip DLP® technology that provides high resistance to deterioration due to aging, the PT-D10000U is a durable and reliable performer.



SXGA+

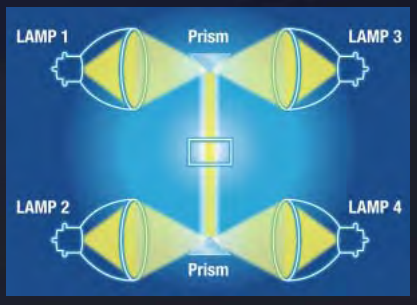
Panasonic's new technologies improve reliability and installation ease

Minimal downtime, high efficiency, and a bright picture.

MULTI-LAMP OPTICAL SYSTEM

Panasonic Original

With Panasonic's original four lamp system, the PT-D10000U generates 10,000-lumen brightness. If one lamp burns out during operation, the remaining lamps provide plenty of light to continue projecting. A lamp relay mode is also included. Extended, continuous operation is possible by lamp mode selection.



Lamp replacement cycle and brightness guidelines

Lamp mode	Light output (lumens)	Lamp replacement cycle (hours)
Four lamps	10,000	2,000
Three lamps	7,500	3,000
Two lamps	5,000	4,000
One lamp	2,500	8,000

*The values above are maximum values when replacing all four lamps simultaneously. The hours may vary depending on the usage conditions. See the back page for details.

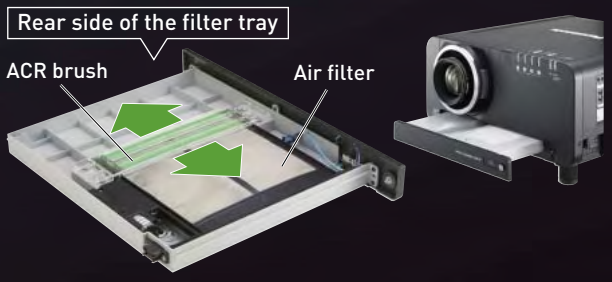
Provides 2,000 hours of use without filter maintenance.

AUTO CLEANING ROBOT (ACR)

AUTO CLEANING ROBOT

Panasonic Original

The PT-D10000U is the world's first*1 projector with an automatic filter cleaning system. When you switch on the projector*2, the air filter operates and the brush of the auto cleaning "robot" removes dust from the filter. This prevents the clogging results in malfunctions and other problems.



■ Micro cut filter

A new filter in the air intake section traps dust particles that are 10 microns*3 or larger. By capturing approximately 7 times as much dust as our previous filters, it guards against optical blocks and reduces the penetration of dust into to the interior to provide stable operation by, for example, preventing drops in brightness.

*1 As of Decemder, 2006. *2 When using the timer, you cannot set the filter to be cleaned more than once every 24 hours. Cleaning occurs either when the system is switched on or when it is cooling down when the specified cleaning time comes. The timer can be set to any time between 00:00 and 23:50 in 10-minute increments. You can also manually clean the filter using the menu on the on-screen display. *3 Individual lint particles and pollen are examples of dust with a size of 10 microns.

Dramatically reduced the size, and enabled 120-VAC operation.

1/2 CONCEPT

World's Smallest 10,000-Lumen DLP® Projector*

*As of December, 2006

This is the first*1 projector with a brightness of 10,000 lumens or more to operate on 120 VAC. And Panasonic's new liquid-cooling system made it possible to significantly downsize the PT-D10000U, making it one of the most compact in its class. The size is 30% smaller than our previous model*2, and the weight and volume are 70% less than our previous model.*2 The PT-D10000U also offers flexible installation and is easy to operate.

*1 As of December, 2006 *2 PT-D9510/PT-D9610

	PT-D9510/PT-D9610	PT-D10000U
Weight	220 lbs	70.5 lbs
Dimensions	W 29-41/64" x H 16-55/64" x D 41-3/8"	W 22-3/4" x H 12-19/32" x D 25-5/16"
Volume	0.33 m³	0.11 m³
Power supply	220-240 V	120 V
Power consumption	2,200 W	1,450 W

HIGH RELIABILITY

New cooling structure

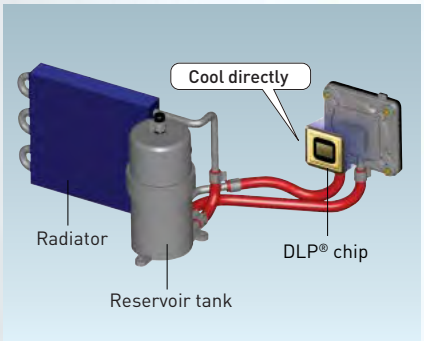
Panasonic Original

In order to further enhance the cooling efficiency, we completely revised the placement of various internal components and combined this with our popular cooling system to enable use in temperatures up to 45°C. This allows use in a wider variety of environments, and keeps the operation more stable even in harsh conditions.

Liquid-cooling system

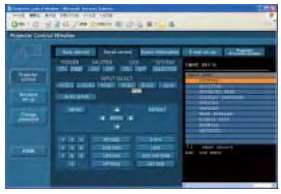
Panasonic Original

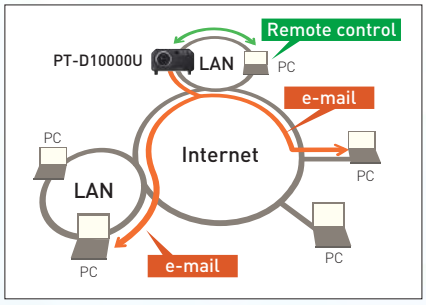
Panasonic's original liquid-cooling system directly cools the DLP® chips, which extends the PT-D10000U's performance and attains a high level of reliability.

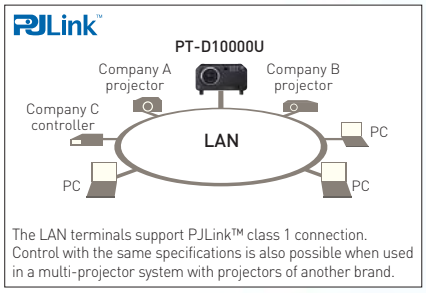


Web browser control/ monitoring and e-mail message alert

Anybody can operate the PT-D10000U by remote control or monitor its status over a LAN network, because it is all done using the computer's familiar web browser. Furthermore, the PT-D10000U sends an e-mail message to notify the operator when an error has occurred, or a lamp needs to be replaced.







The LAN terminals support PJLink™ class 1 connection. Control with the same specifications is also possible when used in a multi-projector system with projectors of another brand.

Lamp LED indicator and self-diagnosis function

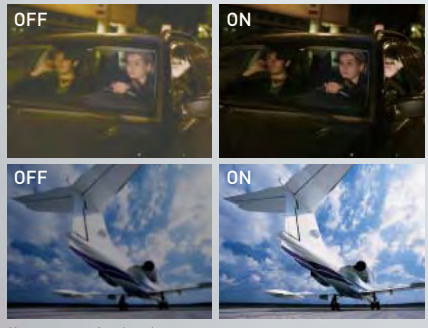
The projector body is equipped with a temperature alarm LED and a burnt-lamp alarm LED (for lamps 1 to 4). In previous models, the LED indicator was visible only from the front. In the PT-D10000U the LED is visible from both front and top, so you can see it easily even if the unit is hung from the ceiling. Information on the location of the error is also given in the on-screen display. A self-diagnosis function is also provided. Error codes displayed on the 3-digit, 7-segment LED on the side of the projector tell the operator where the problem is.

HIGH IMAGE QUALITY/FLEXIBLE INSTALLATION

Dynamic iris

Panasonic Original

Incorporating exclusive Panasonic technology, the dynamic iris opens and closes with exceptional speed and precision as the input signal changes, resulting in accurate, real-time control of the light striking the DLP® chips. The dynamic iris is positioned immediately after the light synthesizer and before the integrator, so it has minimal adverse effect on the overall light uniformity across the screen.



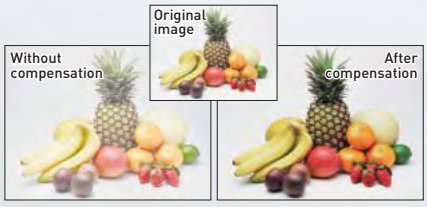
*Images are simulated.

Full 10-bit picture processing

The use of a full 10-bit image processing system provides smooth tonal expression. For example, skin tones appear natural and true to life.

3D color management system

Compensation provides optimal levels of color saturation, hue, and brightness that were not possible with conventional projectors. Colors approach those of the original image, even on large-screen displays.



*Images are simulated.

Progressive cinema scan (3/2 pulldown)

This interlace/progressive conversion technology automatically detects when the input signal is derived from filmed material and selects the optimum progressive processing method to assure faithful reproduction of the original image.

Dynamic sharpness control

The dynamic sharpness control circuit adjusts the video signal waveforms based on the difference in brightness of adjacent pixels for a sharp, clear picture that is relatively unaffected by signal noise.

Horizontal/Vertical lens shift

A wide adjustment range for the horizontal/ vertical lens shift assures virtually distortion-free images and adds convenience and versatility. Fine adjustment is made within ±50 % from center in the vertical direction and within ±30 % from center in the horizontal direction. (Horizontal: powered, Vertical: powered)

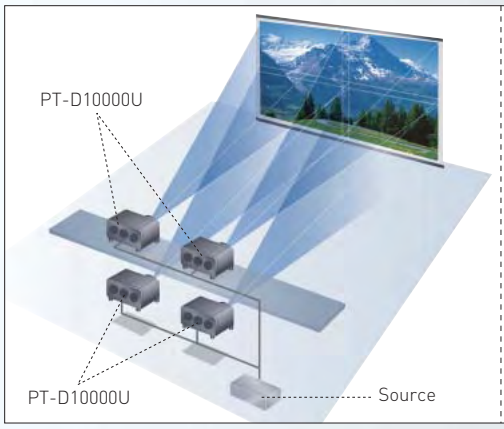
*For the ET-D75LE6, the adjustment is within ±40 % in the vertical direction and ±20 % in the horizontal direction.

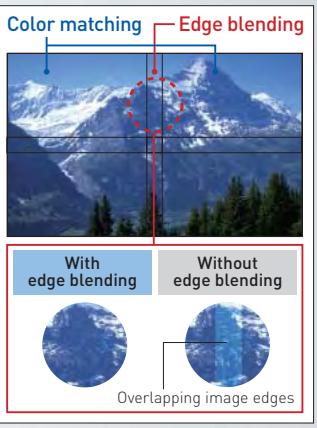
Optional lenses for various venues

Seven optional lenses with different throw distances are available. These powered zoom/focus lenses enable the projector to perform superbly in an array of projection environments. The lens cover opens in both front and top directions, making it easier to install the lens by viewing the mark on the top of the lens.

MULTIPLE SYSTEM APPLIANCE

Built-in multi-screen support system





*When edge blending and color matching are set, the brightness and color balance at the boundaries where screens are joined may lack uniformity due to differences in the uniformity of the screen gain directivity, the brightness of each lamp mode, etc.

Multi-screen processor

The PT-D10000U can project large, multi-screen images without any additional equipment. Up to 100 units (10 x 10) can be edge-blended at a time.

Color matching

When several units are used together, this function corrects for slight variations in the color reproduction range of individual projectors. The PC software assures easy, accurate control. Independent, 7-axis adjustment (red, green, blue, yellow, magenta, cyan, white) ensures high precision and minimizes color variations.

Edge blending

The edges of adjacent screens can be blended and their luminance controlled. For example, the adjoining edges in a 2x2 multi-screen system can be blended to create a smooth, seamless image.

Multiple terminals including DVI-D and LAN slots

The PT-D10000U comes equipped with DVI-D and LAN (PJ-Link™) slots. It also features an array of terminals, including two RGB inputs, a 5-BNC connector and D-sub HD 15-pin, serial in/out, S-video input, two remote inputs, and one remote out. In addition to offering DVI-D control, the PT-D10000U is HDCP*-compliant and thus meets a broad range of projection needs.

*High-Bandwidth Digital Content Protection

Other features

•Mechanical lens shutter •Picture in picture (main/sub input source combinations possible only when using computer and video) •Anti-theft features with chain opening •ID assignment for up to 64 units •Coordinated groups •Digital vertical keystone correction •Built-in test pattern •Selectable 9-language on-screen menu (English, German, French, Spanish, Italian, Russian, Japanese, Chinese, Korean)

UNIVERSAL DESIGN

Easy lamp replacement

You can remove the back cover by removing a single screw. This makes it easy to replace a lamp, even if the projector is suspended from the ceiling or tucked in a hard-to-reach space.

Grooved for easy handling

Grooves on all four sides of the projector's bottom let you get a firm, comfortable grip on the unit and move it safely.

Blind touch operation key/ New remote control

The keys have pits and projections that let you operate the projector by blind touch. A light can also be turned on to illuminate the control panel, for easy operation in a darkened room. The wireless operation range has been extended to 30 m, giving you control from a greater distance. Thanks to the backlight, you can check all the keys on the remote control even in the dark. The lens can also be adjusted using the lens adjustment direct key that was newly added to the remote control.

Ecological-conscious design

Panasonic works from every angle to minimize environmental impact in the product design, production and delivery processes, and in the performance of the product during its life cycle. The PT-D10000U reflects the following ecological considerations.

- Lead-free solder is used to mount components to the printed circuit boards.
- The non-coated cabinet enables easy recycling.
- Lamp power switching further reduces power consumption.
- Auto Power Save activates standby mode when no signal is input.
- The packing case and operating manual are made from recycled paper.

■Optional accessories

Lens

Zoom lens
ET-D75LE6 (1.0 - 1.2:1)
ET-D75LE1 (1.5 - 2.0:1)
ET-D75LE2 (2.0 - 3.0:1)
ET-D75LE3 (3.0 - 5.0:1)
ET-D75LE4 (5.0 - 8.0:1)
ET-D75LE8 (7.9 - 15.0:1)

Fixed focus lens
ET-D75LE5 (0.8:1)

ET-D75LE1

Lamp

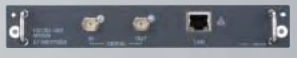
Replacement lamp unit
ET-LAD10000
ET-LAD10000F (four pack)

ET-LAD10000

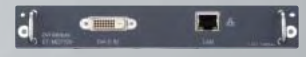
Input signal board*

SD-SDI Input signal board
ET-MD77SD1

HD/SD Input signal board
ET-MD77SD3



DVI-D Input signal board
ET-MD77DV



Frame

ET-PFD100

Carrying handle

ET-HAD100

Ceiling mount bracket

High-ceiling mount bracket
ET-PKD100H

Low-ceiling mount bracket
ET-PKD100S

*The LAN terminal on each board, when mounted, cannot be used because the LAN terminal on the main unit has priority.

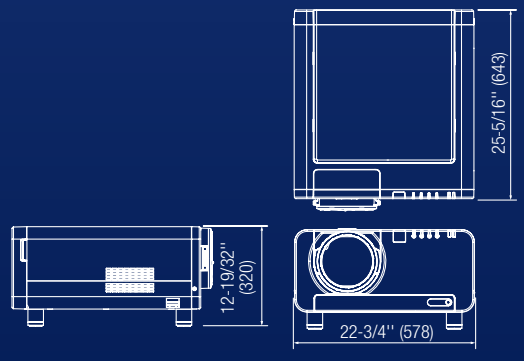
Specifications

DLP®chip	Panel size	0.95" diagonal (4:3 aspect ratio)
	Display method	DLP® chip x 3 (R, G, B), DLP® projection system
	Pixels	1,470,000 (1,400 x 1,050) x 3, total of 4,410,000 pixels
Lamp		250 W UHM™ lamp x 4 (four lamp system)
Brightness		10,000 lumens (four-lamp operation mode)
Contrast ratio		5,000:1 (full on/full off, in Dynamic iris 3 mode)
Resolution	RGB	1,400 x 1,050 pixels (1,600 x 1,200 pixels compatible, compression mode)
	Video	560 TV lines
Lens		Optional powered zoom/focus lenses
Screen size		70 - 600 inches, 4:3 aspect ratio (70-300 inches, 4:3 aspect ratio with the ET-D75LE5)
Lens shift		Vertical, Horizontal (powered)
RGB input scanning frequency		fH 15-100 kHz, fv 24-120 Hz Dot clock 20-162 MHz
Component signal		480i, 480p, 576i, 576p, 720/60p, 720/50p, 1035/60i, 1080/25p, 1080/24p, 1080/24sF, 1080/30p, 1080/60i, 1080/50i, 1080/50p, 1080/60p
Video signal		fH 15.75/15.63 kHz, fv 50/60Hz (NTSC,NTSC4.43,PAL,PAL60,PAL-N,PAL-M,SECAM)
Terminals	VIDEO IN	BNC x 1, 1.0 Vp-p
	VIDEO OUT	BNC x 1, 1.0 Vp-p
	S-VIDEO IN	Mini DIN 4-pin x 1
	RGB1/YPBPR IN	BNC x 5
	RGB2 IN	D-sub HD 15-pin x 1
	DVI-D IN	24-pin x1, DVI 1.0 compliant, HDCP compatible
	SERIAL IN	D-sub 9-pin female x 2 (RS232C x 1, RS422 x 1)
	SERIAL OUT	D-sub 9-pin male x 1 (RS422 x 1)
	REMOTE 1 IN	M3 jack x1 for wired remote control
	REMOTE 1 OUT	M3 jack x1 for link control
	REMOTE 2 IN	D-sub 9-pin female x 1 for external control (parallel)
	LAN	RJ-45 (10 Base-T/100 Base-TX) x 1, compatible with PJLink™
Keystone correction range		±40° (±22° with the ET-D75LE5, ±28° with the ET-D75LE6)

Installation	Front/rear, ceiling/floor
Power cord length	9.9'' (3.0 m)
Power supply	120 V AC, 20 A, 60 Hz
Power consumption	1,450 W (25 W in standby mode with fan stopped)
Dimensions (W x H x D)	22-3/4'' x 12-19/32'' x 25-5/16'' (578 x 320 x 643 mm) (without lens)
Weight	70.5 lbs (32 kg) without lens
Operating temperature	32 -113 °F (0 -45 °C) *The highland mode is for use at high altitudes. When using the unit at altitudes of 1,400 to 2,700 meters, the ambient temperature is 0 °C-40 °C.
Operating humidity	10-80% (no condensation)
Supplied accessories	Power cord, Wireless/wired remote control unit, Batteries for remote control (3V AA battery x2)

Dimensions

unit: inch [mm]



Shape of the plug receptacle

•AC120 V AC, 20 A

Projection distance

[feet/meters]

Diagonal image size (aspect raio: 4:3)	Throw distance												
	ET-D75LE1 1.5-2.0:1		ET-D75LE2 2.0-3.0:1		ET-D75LE3 3.0-5.0:1		ET-D75LE4 5.0-8.0:1		ET-D75LE8 7.9-15.0:1		ET-D75LE6 1.0-1.2:1		ET-D75LE5 0.8:1
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	fixed
70''	6.9 / 2.1 m	9.0 / 2.7 m	9.2 / 2.9 m	13.8 / 4.2 m	13.9 / 4.3 m	23.2 / 7.0 m	23.3 / 7.2 m	37.3 / 11.3 m	36.4 / 11.1 m	69.3 / 21.1 m	4.6 / 1.4 m	5.4 / 1.6 m	3.3 / 1.0 m
100''	9.9 / 3.0 m	13.1 / 3.9 m	13.3 / 4.1 m	19.9 / 6.0 m	20.0 / 6.1 m	33.4 / 10.1 m	33.5 / 10.2 m	53.4 / 16.2 m	52.6 / 16.1 m	99.5 / 30.3 m	6.7 / 2.1 m	7.8 / 2.4 m	4.9 / 1.4 m
200''	19.9 / 6.1 m	26.5 / 8.0 m	26.8 / 8.2 m	40.1 / 12.2 m	40.2 / 12.3 m	67.2 / 20.4 m	67.3 / 20.6 m	107.2 / 32.6 m	106.3 / 32.5 m	200.3 / 61.0 m	13.5 / 4.1 m	16.0 / 4.8 m	10.0 / 3.0 m
300''	30.0 / 9.2 m	40.0 / 12.1 m	40.3 / 12.3 m	60.3 / 18.4 m	60.5 / 18.5 m	101.0 / 30.8 m	101.1 / 30.9 m	160.9 / 49.0m	160.1 / 48.8 m	301.0 / 91.7 m	20.2 / 6.2 m	24.1 / 7.3 m	15.2 / 4.6 m
400''	40.1 / 12.2 m	53.4 / 16.2 m	53.8 / 16.4 m	80.6 / 24.5 m	80.7 / 24.6 m	134.8 / 41.1 m	134.9 / 41.2 m	214.7 / 65.4 m	213.9 / 65.2 m	401.8 / 122.5 m	27.0 / 8.3 m	32.2 / 9.8 m	—
600''	60.2 / 18.4 m	80.3 / 24.4 m	80.8 / 24.7 m	121.1 / 36.9 m	121.2 / 37.0 m	202.4 / 61.7 m	202.6 / 61.8 m	322.2 / 98.2 m	321.4 / 98.0 m	603.3 / 183.9 m	40.6 / 12.4 m	48.5 / 14.8 m	—

Diagonal image size (aspect raio: 16:9)	Throw distance												
	ET-D75LE1 1.5-2.0:1		ET-D75LE2 2.0-3.0:1		ET-D75LE3 3.0-5.0:1		ET-D75LE4 5.0-8.0:1		ET-D75LE8 7.9-15.0:1		ET-D75LE6 1.0-1.2:1		ET-D75LE5 0.8:1
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	fixed
70''	7.4 / 2.3m	9.9 / 3.0 m	10.0 / 3.1 m	15.1 / 4.6 m	15.1 / 4.7 m	25.4 / 7.7 m	25.4 / 7.8 m	40.7 / 12.3 m	39.8 / 12.2 m	75.7 / 23.0 m	5.0 / 1.6 m	6.0 / 1.8 m	3.6 / 1.1 m
100''	10.7 / 3.3 m	14.3 / 4.3 m	14.4 / 4.5 m	21.7 / 6.6 m	21.7 / 6.9 m	36.4 / 11.1 m	36.5 / 11.2 m	58.3 / 17.7 m	57.3 / 17.5 m	108.6 / 33.1 m	7.2 / 2.2 m	8.6 / 2.6 m	5.3 / 1.6 m
200''	21.7 / 8.9 m	29.0 / 8.8 m	29.2 / 8.9 m	43.8 / 13.3 m	43.8 / 13.4 m	73.3 / 22.3 m	73.3 / 22.4 m	116.8 / 35.8 m	115.9 / 35.4 m	218.4 / 66.5 m	14.6 / 4.5 m	17.5 / 5.3 m	11.0 / 3.3 m
300''	32.6 / 10.0 m	43.6 / 13.2 m	43.9 / 13.4 m	65.8 / 20.0 m	65.9 / 20.1 m	110.1 / 33.5 m	110.2 / 33.6 m	175.4 / 53.4 m	174.5 / 53.2 m	328.2 / 100.0 m	22.0 / 6.7 m	26.3 / 8.0 m	16.6 / 5.0 m
400''	43.6 / 13.3 m	58.3 / 17.7 m	58.6 / 17.9 m	87.9 / 26.7 m	87.9 / 26.9 m	147.0 / 44.7 m	147.0 / 44.9 m	234.0 / 71.3 m	233.1 / 71.1 m	437.9 / 133.4 m	29.3 / 9.0 m	35.2 / 10.7 m	—
600''	65.5 / 20.0 m	87.5 / 26.6 m	88.0 / 26.9 m	132.0 / 40.2 m	132.0 / 40.3 m	220.7 / 67.2 m	220.7 / 67.3 m	351.2 / 107.0 m	350.3 / 106.8 m	657.5 / 200.4 m	44.1 / 13.5 m	52.9 / 16.1 m	—

NOTES ON USE

Notes on Projector Placement and Operation:

The projector uses a high-wattage lamp that becomes very hot during operation. Please observe the following precautions.

1. Never place objects on top of the projector while it is operating.
2. Make sure there is an unobstructed space of 500 mm or more around the projector's exhaust openings.
3. Do not stack projector units directly on top of one another for the purpose of multiple (stacked) projection. When stacking projector units, be sure to provide the amount of space indicated below between them. These space requirements also apply to installations where only one projector unit is operating at one time and the other unit is used as a backup.
4. If the projector is placed in a box or enclosure, ensure the temperature of the air surrounding the projector is between 0°C and 35°C. Also make sure the projector's intake and exhaust openings are not blocked. Take particular care to ensure that hot air from the exhaust openings is not sucked into the intake openings.
5. Because the ET-D75LE5 is a fixed short-throw lens, the lens shift function cannot be used with it.

Operating the Projector Continuously:

1. If the projector is to be operated continuously 24 hours a day, use the multi-lamp optical system's alternating lamp operation (lamp changer) function. The projector can be operated continuously 24 hours a day in four-lamp operation mode,but it will automatically operate with three lamps for 8 hours of the 24 hours.
2. The lamp replacement cycle duration becomes shorter if the projector is operated repeatedly for short periods.

- The projector uses a high-voltage mercury lamp that contains high internal pressure. This lamp may break, emitting a large sound, or fail to illuminate, due to impact or extended use. The length of time that it takes for the lamp to break or fail to illuminate varies greatly depending on individual lamp characteristics and usage conditions.
- The brightness of the lamp will gradually decrease with use.

Panasonic®

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Please contact Panasonic or your dealer for a demonstration.

JQA-1617

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PT-D10KU1-06Nov30K Printed in Japan.

Specifications

General

System ..... DVD player
Power requirements ..... AC 120 V, 50/60 Hz
Power consumption ..... 11 W
Power consumption (standby) ..... 0.7 W
Weight ..... 2.5 kg / 5 lb 8 oz
Dimensions ..... 420 (W) x 55 (H) x 283 (D) mm (16.5 (W) x 2.2 (H) x 11.1 (D) in.)
Operating temperature ..... +5 °C to +35 °C (+41 °F to +95 °F)
Operating humidity ..... 5 % to 85 % (no condensation)

Component Video Output

Y (luminance) - Output level ..... 1 Vp-p (75 Ω)
PB (color) - Output level ..... 0.65 Vp-p (75 Ω)
PR (color) - Output level ..... 0.65 Vp-p (75 Ω)
Jack ..... RCA jacks

S-Video Output

Y (luminance) - Output level ..... 1 Vp-p (75 Ω)
C (color) - Output level ..... 265 mVp-p (75 Ω)
Jack ..... S-video jack

Video Output

Output level ..... 1 Vp-p (75 Ω)
Jack ..... RCA jack

Audio Output (1 Stereo Pair)

Output level ..... During audio output 200 mVrms (1 kHz, –20 dB)
Number of channels 2
Jack ..... RCA jacks

Digital Audio Characteristics

Frequency response ..... 4 Hz to 44 kHz (DVD fs: 96 kHz)
S/N ratio ..... 118 dB
Dynamic range ..... 105 dB
Total harmonic distortion ..... 0.0025 %
Wow and flutter ..... Limit of measurement (±0.001 % W. PEAK) or lower

Other Terminals

Coaxial digital output ..... RCA jack
RS-232C ..... D-sub 9-pin, male
RS-232C and extended ..... D-sub 15-pin, female

Accessories

Audio/video cable 1
Power cable 1
Remote control 1
AA/R6P dry cell batteries 2
Operating Instructions 1
Warranty card 1

Note

The specifications and design of this product are subject to change without notice, due to improvement.

CX 8-channel

Professional Power Amplifiers

CX168 | CX108V

Designed for permanently installed sound systems where rackspace is at a premium, QSC's CX108V and CX168 provide unprecedented levels of channel density for multi-channel amplifiers. The CX108V and CX168 provide 100 watts per channel at 70 volts and 90 watts per channel at 8 ohms respectively. With both models, each pair of channels may be bridged to configure these amplifiers as 4, 5, 6 or 7 channel units. Like the entire CX Series, the 8 channel models feature DataPorts for remote amplifier management or signal processing, incorporate QSC's legendary PowerLight® technology, and deliver our unmatched reputation for quality and reliability.

QSC's PowerLight technology takes your audio to an entirely new level. Delivering tighter bass and clean, transparent highs, PowerLight also cuts waste heat, boosts reliability, and eliminates unwanted noise and hum. PowerLight is a revolutionary switching power supply technology that provides ample current to the audio power circuitry by charging the supply rails over 200,000 times per second through an ultra-low noise impedance circuit. Unlike amplifiers that use conventional supplies, the audio signal is never starved prematurely and remains crisp and clean.

CX 8-channel Amplifiers

	Watts per channel		
Model	70V*	8Ω	4Ω**
CX168	–	8 x 90	8 x 130
CX108V	8 x 100	–	–

20 Hz - 20 kHz, 0.05%THD
** 20 Hz - 20 kHz, 0.2%THD*
***20 Hz - 20 kHz, 0.1%THD*

PowerLight is a registered trademark of QSC Audio Products, Inc.

Features

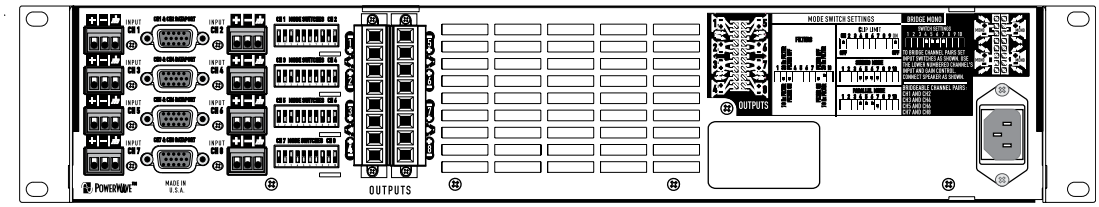
- 100 watts per channel at 70 volts (CX108V)
- 90 watts per channel at 8 ohms and 130 watts per channel at 4 ohms (CX168)
- Compact size — only two rack spaces and 14" deep for reduced rack space
- Channel pairs bridgeable for maximum flexibility
- Exclusive PowerLight switch-mode power supply technology for high performance and compact size
- Active inrush limiting eliminates AC inrush current, removing the need for expensive power sequencers
- Four HD15 DataPorts (one per channel pair) for QSControl computer control or QSC's signal processing accessories
- Custom integrated gain control security cover for tamper proof installations
- 1 dB recessed detented gain controls for fast and accurate settings
- Detachable euro style input and output connectors
- DIP switch control for clip limiters, high-pass filters, bridge mono and parallel operation
- Selectable high-pass filters protect speakers and prevent speaker transformer saturation with minimal effect on program material (50 Hz or 75 Hz; CX108V) (33 Hz or 70 Hz; CX168)
- Comprehensive front panel indicators including signal, clip, bridge mono and parallel-input LEDs
- Fully protected — including DC, infrasonic and ultrasonic, thermal overload and short circuit protection
- High-performance Class AB+B complementary bipolar output circuitry
- Lightweight — only 21 pounds (9.5 kg) for easier racking and shipping
- 3 year warranty plus optional 3 year extended service contract

CX 8-Channel

Specifications

		CX168		CX108V
Stereo Mode (all channels driven)		Continuous average output power per channel		
8Ω / 20 Hz - 20 kHz / 0.05% THD		90 W		–
4Ω / 20 Hz - 20 kHz / 0.1% THD		130 W		–
Midband Ratings		All channels driven	Single channel	
8Ω / 1 kHz / 0.1% THD		100 W	120 W	–
4Ω / 1 kHz / 0.1% THD		140 W	180 W	–
70V / 20 Hz - 20 kHz / 0.2% THD		–		100 W
Bridge Mono Mode		Bridge mono mode operation		
16Ω / 20 Hz - 20 kHz / 0.1% THD		180 W		–
8Ω / 20 Hz - 20 kHz / 0.1% THD		260 W		
140V / 20 Hz - 20 kHz / 0.2% THD		–		200 W
Signal to Noise (20 Hz - 20 kHz)		-107 dB		-100 dB
Input Sensitivity		1.35 Vrms at 8Ω		1.26 Vrms at 70V
Voltage Gain		20x (26 dB)		56x (35 dB)
Input Clipping		6 Vrms (+18 dBu)		6 Vrms (+18 dBu)
Output Circuitry		AB+B		AB+B
Frequency Response		20 Hz - 20 kHz, + 0.2 dB | 8 Hz - 50 kHz, +0/-3 dB		20 Hz - 20 kHz, + 0.4 dB | 8 Hz - 70 kHz, +0/-3 dB
Damping Factor		> 200 (5 kHz and below)		> 500 (5 kHz and below)
Input Impedance		6k ohms unbalanced, 22k ohms balanced		6k ohms unbalanced, 22k ohms balanced
Distortion (SMPTE-IM)		< 0.02%		
Distortion (typical)				
20 Hz - 20 kHz: 10 dB below rated power		< 0.1% THD		
1.0 kHz and below: full rated power		< 0.03% THD		
Cooling		Variable-speed fan / rear-to-front air flow through tunnel heat sink		
Connectors		Input: 3-pin euro-style detachable terminal blocks (one per channel) DataPort: HD-15 connector (Ch. 1+2, 3+4, 5+6, 7+8) Output: two 8-pin euro style detachable terminal blocks		
Controls		Front: AC switch, Ch. 1, 2, 3, 4, 5, 6, 7 & 8 gain knobs Rear: DIP switches for Ch. 1 - 8, clip limiter on/off, LF filter on/off, LF filter freq select 33 or 70 Hz for CX168 LF filter freq select 50 or 75 Hz for CX108V, inputs parallel or stereo; bridge mode		
Indicators		Power-On: Green LED / Parallel inputs: Orange LED (1 per channel pair) / Signal -35 dB: Green LED (1 per channel) Bridged: Yellow LED (1 per channel pair) / Clip: Red LED (1 per channel)		
Amplifier Protection		Full short circuit, open circuit, thermal, ultrasonic, and RF protection. Stable into reactive or mismatched loads		
Load Protection		On/off muting, individual channel DC fault blocking		
Dimensions (HWD)		3.5" (8.9 cm) 2 rack spaces x 19" (48.3 cm) rack mounting x 14" (35.6 cm) from front mounting rails		
Weight - Net / Shipping		21 lbs (9.5 kg) / 27 lbs (12.3 kg)		
Power Requirements		100, 120, 230 VAC, 50 - 60 Hz (configured at factory)		
120V Current Consumption*	Idle	0.6 A		0.6A
1/8 power pink noise (typical of program material at maximum unclipped power)	8Ω	6.2 A		–
	4Ω	9.2 A		–
	70V	–		6.3 A
1/3 power pink noise (typical of program material with severe clipping)	8Ω	9.2 A		–
	4Ω	14.2 A		–
	70V	–		9.4 A

** Multiply currents by 0.5 for 230V units*



Specifications subject to change without notice.

1675 MacArthur Boulevard • Costa Mesa, CA 92626 • Ph: 800/854-4079 or 714/957-7100 • Fax: 714/754-6174

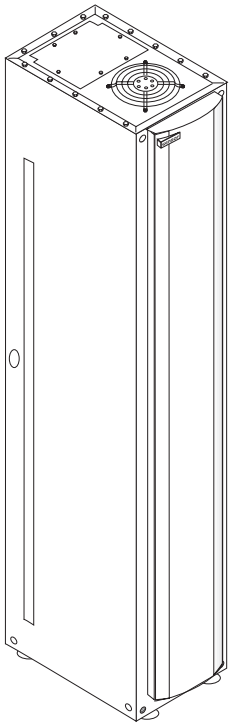
qscaudio.com

ETC

Sensor®+ Racks

Sensor+ Series

100V 120V



GENERAL INFORMATION

Sensor+ dimming systems provide high density, professional features and exceptional reliability for lighting applications that require the best the entertainment industry can offer.

APPLICATIONS

- Professional and educational theatre
- Production studios
- Concert and performance halls
- Themed retail and dining
- Multi-use Convention Centers
- Houses of Worship

FEATURES

- High dimmer density
- Up to two 2.4kW dimmers per module
- 6, 12, 24, and 48 module racks available
- Rugged industrial construction
- Installation flexibility
- Adaptable modular design
- 100,000A Short Circuit Current Rating (SCCR)
- Advanced configuration editing built into rack
- Stores up to 128 Presets in memory
- Direct Ethernet control signal input
- Two DMX512 inputs
- Standard system and rack monitoring with diagnostic reporting
- Supports ETC Dimmer Doubling™
- All racks UL and cUL LISTED

ACCESSORIES

- SmartLink Button Stations
- Dimmer Doubler
- Sound Suppression Hood
- Floor pedestal for 24-module rack
- Document holder

ORDERING INFORMATION

Installation Racks

MODEL	DESCRIPTION
SR48+	Sensor+ 48 Module Rack
SR24+	Sensor+ 24 Module Rack
SR12+	Sensor+ 12 Module Rack
SR6+	Sensor+ 6 Module Rack
SR24+1P	Sensor+ 24 Module Single Phase Rack
SR12+1P	Sensor+ 12 Module Single Phase Rack
SR6+1P	Sensor+ 6 Module Single Phase Rack

Rack Options*

MODEL	DESCRIPTION
AT48	Amp-Trap fuse option for 48-module rack
AT24	Amp-Trap fuse option for 24-module rack
AT12	Amp-Trap fuse option for 12-module rack
BK48	Bussing kit for 2 – 48-module racks
BK24	Bussing kit for 2 – 24-module racks
BK12	Bussing kit for 2 – 12-module racks
AUX30-48	30″ Auxiliary Rack(s) for 48-module rack
AUX19-48	19″ Auxiliary Rack(s) for 48-module rack
AUX12-48	12″ Auxiliary Rack(s) for 48-module rack
AUX19-24	19″ Auxiliary Rack(s) for 24-module rack
AUX19-12	19″ Auxiliary Rack(s) for 12-module rack

*Vibration Reduction mounts available for all Sensor+ racks. Contact ETC for details

Rack Accessories

MODEL	DESCRIPTION
SSSh24-48	Sensor+ Sound Suppression Hood – large
SSSh6-12	Sensor+ Sound Suppression Hood – small
Pedestal	Floor pedestal for 24-module rack
DH	Document Holder

SmartLink Accessories

MODEL	DESCRIPTION
S-LPB	SmartLink Power Board for Sensor+ Racks*
S-10005	SmartLink 5-Button Station*
S-10010	SmartLink 10-Button Station*

* One SmartLink Power Board required for station support.
S-LPB supports up to four stations.
Only one S-LPB may be enabled in a system.

SPECIFICATIONS

GENERAL

- Racks available in four sizes
  - SR6+ 6 modules, 12 dimmers maximum
  - SR12+ 12 modules, 24 dimmers maximum
  - SR24+ 24 modules, 48 dimmers maximum
  - SR48+ 48 modules, 96 dimmers maximum
- Dual density (two dimmers per module), single density and half density dimmer modules available
- Operating temperature: 0-40°C / 32-104°F
  - Dimmer room HVAC systems must at all times maintain the specified ambient temperature at the dimmer rack. Dimming systems operating within 10 degrees F of the upper or lower temperature limits must strictly follow installation and operation guidelines to operate reliably.
- Relative humidity: 30-90% non-condensing
- All racks UL and cUL LISTED
- UL924 LISTED for Bypass operation

MECHANICAL

- Rugged 16-gauge steel construction
- Fine-textured, scratch-resistant, epoxy paint
- SR6+ and SR12+ uses wall mount installation
- SR24+ can be wall or pedestal mounted
- SR48+ is floor mounted
- Top and bottom conduit access through removable panels (SR48+) or knockouts (SR6+, SR12+, and SR24+)
- No tools required for module removal or installation
- Keyed module slots prevent insertion of inappropriate module types
- Front access to all wiring and terminations
- Full height locking door
- Electrostatic air filter easily removed from door for periodic cleaning
- High efficiency cooling system with airflow sensor
- High visibility LED status beacon

ELECTRICAL

- SR6+, SR12+ and SR24+ accept:
  - Three phase 120/208 VAC
  - Single phase 120/240 VAC
- SR48+ accepts
  - Three phase 120/208 VAC
- Line feed frequencies from 47-63Hz
- Line feed voltage range is 90-140 VAC
- Load terminals accept up to #4 AWG (16mm^2) wire (see chart)
- Short Circuit Current Rating: 100,000A RMS symmetrical @ 240VAC
- Auxiliary equipment racks and custom switchgear/distribution available (Call ETC for details)

CONTROL ELECTRONICS

- Sensor+ Control Electronics Module (CEM+)
- Single Ethernet control signal input
- Two DMX512 inputs
- Standard diagnostic reporting via browser-based interface or DimStat software
- Supports Dimmer Doubling™
- Supports SmartLink control of presets

OPTIONS

- Advanced Features™ dimmer-specific load and diagnostic reporting
- Amp-Trap® fuses to allow feeding individual racks from oversize mains
- Bus kits available
- Vibration reduction kits available for all racks
- SmartLink Power Board

ADDITIONAL INFORMATION

Compatible Dimmer Modules

SENSOR STANDARD MODULES	
MODEL	**DESCRIPTION**
D15/D20	Dual 15A/20A Dimmer Module – 350µS
D15E/D20E	Dual 15A/20A Dimmer Module – 500µS
D50AF	Single 50A Dimmer Module – 500µS – AF
D100AF*	Half 100A Dimmer Module – 500µS – AF
SENSOR SPECIAL PURPOSE MODULES	
L10	Dual 10A Low Wattage Dimmer Module
L10F	Single 10A Low Wattage Fluorescent Dimmer Module
D15F/D20F	Single 15A/20A Fluorescent Dimmer Module
R15/R20	Dual 15A/20A Relay Module
CC15/CC20	Dual 15A/20A Constant Circuit Breaker Module
AFM	Air Flow Module

*Half-density modules use two module slots

Control Modules

MODEL	DESCRIPTION
CEM+	Control Electronics Module +

Load Wiring Lug Capacity

CONNECTION	WIRE SIZE
10A, 15A, 20A, and 50A lugs	4 AWG Max. (16mm^2)
100A lugs	2/0 Max.

Primary Feed Lug Capacity

CONNECTION	WIRE SIZE
SR48+	Dual 600 kcmil – 2 AWG
SR24+	Dual 350 kcmil – 4 AWG
SR12+	Dual 250 kcmil – 6 AWG
SR6+	Single 2/0 – 14 AWG

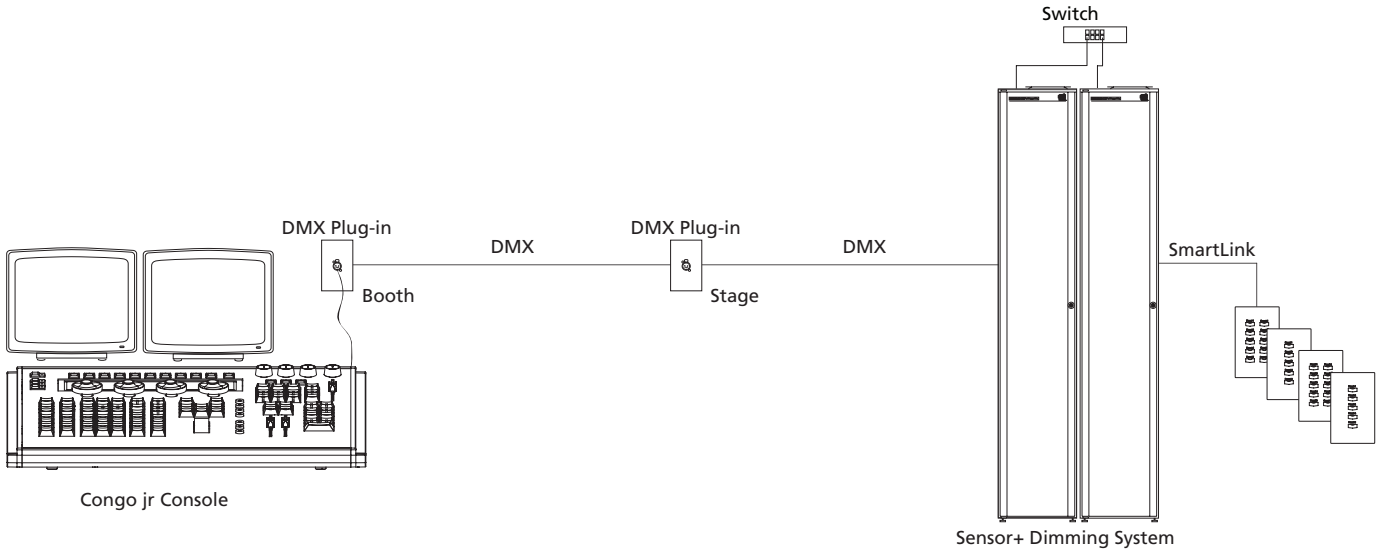
Sound Pressure Level (dBA)

MODEL	dBA @ 1000Hz (1kHz)*	
	WITHOUT	WITH SSSh**
SR48+	37.0	30.9
SR24+	40.2	34.0
SR12+	41.8	33.8
SR6+	26.0	21.4

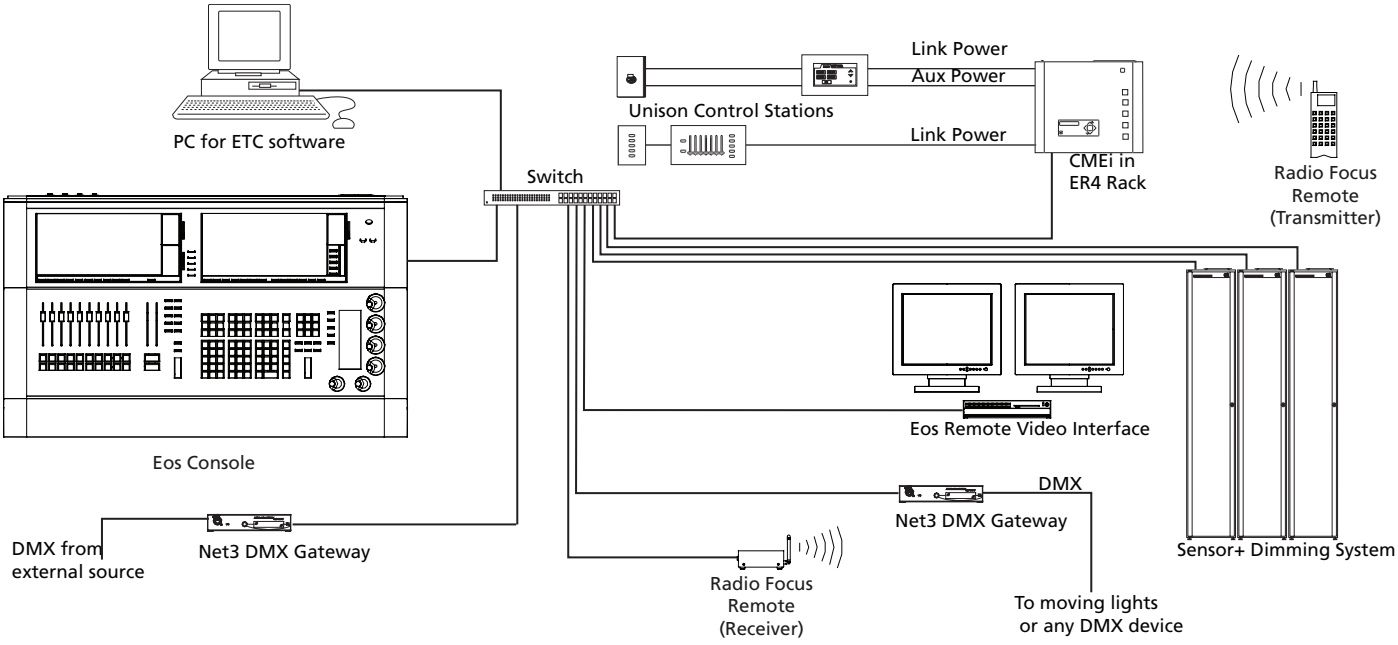
* dBA values for each Sensor rack measured at 1 meter. Visit www.etcconnect.com for full spectrum dBA ratings.

** Sensor Sound Supression Hood (SSSh)

TYPICAL SYSTEM RISER



TYPICAL NETWORK RISER



PHYSICAL

Empty Dimmer Rack Weights

MODEL	WEIGHT		SHIPPING WEIGHT	
	lbs	kgs	lbs	kgs
SR48+	188	86	198	90
SR48+ Door*	31	14	35	16
SR24+	107	49	115	53
SR24+ Door*	17	8	20	9
SR12+	45	21	50	23
SR12+ Door*	11	5	14	6.5
SR6+ with Door	36	16	45	21

*Rack doors ship separately

Full Dimmer Rack Weights

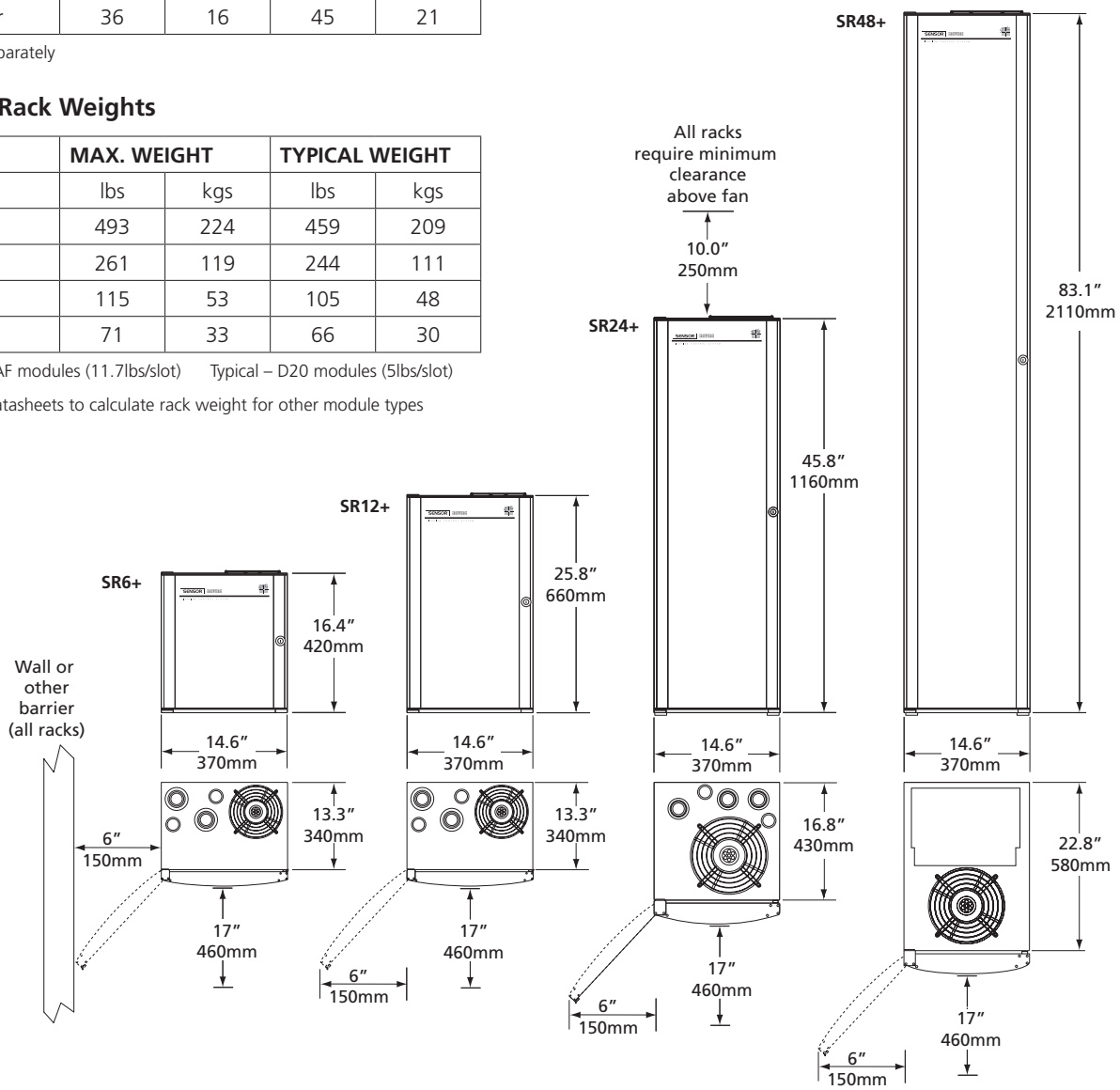
MODEL	MAX. WEIGHT		TYPICAL WEIGHT	
	lbs	kgs	lbs	kgs
SR48+	493	224	459	209
SR24+	261	119	244	111
SR12+	115	53	105	48
SR6+	71	33	66	30

*Maximum – D100AF modules (11.7lbs/slot) Typical – D20 modules (5lbs/slot)

Refer to module datasheets to calculate rack weight for other module types

Installation Rack Dimensions

MODEL	HEIGHT		WIDTH		DEPTH	
	inches	mm	inches	mm	inches	mm
SR48+	83.1	2110	14.6	370	22.8	580
SR24+	45.8	1160	14.6	370	16.8	430
SR12+	25.8	660	14.6	370	13.3	340
SR6+	16.4	420	14.6	370	13.3	340



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Sensor® products protected by one or more of the following U.S. Patent Numbers 5,323,088, 5,352,088, 7,233,112, 7,019,469, 6,849,943, and 6,002,563; European Number 0603333T2; German 69203609.

SHARP

print

LC-22SB24U | Televisions

Sharp's LC-22SB24U is a widescreen HDTV LCD TV that provides a slim design, high-definition TV solution with a distinctive small foot print. It features a high-performance LCD panel for high brightness, a high contrast ratio, low-reflection glare protection and wide viewing angles. The LC-22SB24U includes ATSC/NTSC tuners to receive off-air broadcasts as well as a digital cable QAM capability to receive non-scrambled digital cable programming. In addition, the LC-22SB24U is PC compatible and is an HDTV monitor for greater versatility. As an HDTV monitor, it is compatible with all 1080i and 720p signals from HDTV sources.

Features

- **16:10 Aspect Ratio (1680 x 1050) ASV LCD Panel**
  displays 16:10 widescreen programs in their native aspect ratio.
- **Built-in ATSC/QAM/NTSC Tuners**
  for DTV and analog TV viewing.
- **High Brightness**
  Sharp LCD TVs are very bright, so you can put them virtually anywhere – even near windows, doors or other light sources – and their picture is still vivid.
- **HDMI™ Input**
  for convenient connection to digital devices.
- **50,000-Hour Lamp Life[1]**
  Sharp's LCD backlight life is long enough to give you viewing pleasure for many years.
- **High Contrast Ratio**
  provides incredible images whether you're watching dark or bright scenes.

Specifications

Screen Size	22" Class (21-63/64" Diagonal)
Panel Type	Active Matrix (a-si TFT) LCD
Pixel Resolution	1680 x 1050
Tuning System	ATSC/QAM/NTSC
Brightness	300 cd/m^2
Viewing Angles	170º H x 160º V
Lamp Life	50,000 Hours[1]
Audio System	1.5 watt x 2
Contrast Ratio	1000:1
Aspect Ratio	16:10
HDMI™ Input	1
PC Input	Yes (Analog RGB x 1)
Component Input	Y/Pr/Pb x 1
S-Video Input	4-pin DIN x 1
Composite Video Input (A/V)	RCA x 1
Audio Inputs	RCA L/R x 3, 3.5mm Stereo Jack x 1
Audio Outputs	Headphone Jack, 3.5mm x 1, Digital Audio Output x 1
Power Consumption AC	60 W
Power Source	120V
ENERGY STAR® Qualified	Yes[2]
Limited Warranty	1-Year parts, 90 days labor from date of purchase
Cabinet Color	Black with titanium base
TV Dimensions (w x h x d)	TV and Stand: 21-1/8" x 17-1/4" x 8-7/8" TV Only: 21-1/8" x 15-7/8" x 2-5/8"
Net Weight	TV and Stand: 11.5 lbs. TV Only: 9.9 lbs.
UPC	074000371132

[1]The typical period of time after which the lamp's power output will have decreased by about half, give the LCD TV is used continuously in a 77 degree F room under standard lighting and brightness conditions.

[2]This product meets ENERGY STAR® guidelines for energy efficiency. ENERGY STAR is a U.S. registered mark of the Environmental Protection Agency.

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SHARP

print

LC-26SB24U | Televisions

Sharp's LC-26SB24U provides a convenient 26" Class (26" Diagonal) HDTV solution with a distinctive design. The LC-26SB24U features a high-performance LCD panel for high-brightness, a high contrast ratio, low-reflection glare protection and wide viewing angles.

Features

- **True 16:9 Aspect Ratio (1366 x 768) LCD Panel**
  displays 16:9 widescreen programs in their native aspect ratio without the need for scaling or other video processing.
- **Built-in ATSC/QAM/NTSC Tuners**
  for DTV and analog TV viewing.
- **High Brightness (500 cd/m^2)**
  Sharp's LCD TVs are very bright, so you can put them virtually anywhere – even near windows, doors or other light sources – and their picture is still vivid.
- **Dual HDMI™ Inputs**
  for convenient connection to digital devices.
- **160º H x 150º V Viewing Angles**
  are so wide you can view Sharp LCD TVs from virtually anywhere in the room.
- **60,000 Hour Lamp Life[1]**
  Sharp's LCD backlight life is long enough to give you viewing pleasure for many years.
- **8ms Response Time**
  ensures your will enjoy fast-motion video with minimal blur.
- **PC Input**
  easily turns your TV into a PC monitor.

Specifications

Screen Size	26" Class (26" Diagonal)
Panel Type	Active Matrix (a-si TFT) LCD
Pixel Resolution	WXGA (1366 x 768)
Tuning System	ATSC/QAM/NTSC
Brightness	500 cd/m^2
Lamp Life	60,000 Hours[1]
Viewing Angles	160º H x 150º V
Audio System	5W x 2
Native Contrast Ratio	800:1
Aspect Ratio	16:9
Response Time	8ms
PC Input	15-pin RGB x 1
HDMI™ Input	HDMI x 2
Component Input	Y/Pr/Pb x 1
S-Video Input	4-pin DIN x 1
Composite Video Input	RCA x 2
Audio Input	RCA L/R x 2, Mini Jack x 1
Speakers Location / Type	Bottom/Fixed
Power Consumption AC	115W
Power Source	120V
Limited Warranty	1 year parts, 90 days labor from date of purchase
Cabinet Color	Black
Dimensions (w x h x d)	TV and Stand: 26-5/16" x 19-11/16" x 9-9/16" TV Only: 26-5/16" x 17-3/4" x 4-9/16"

Weight	TV and Stand: 24.3 lbs. TV Only: 20.9 lbs.
UPC	074000371101

[1]The typical period of time after which the lamp's power output will have decreased by about half, given that the LCD TV is used continuously in a 77 degree F room under standard lighting and brightness conditions.

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VL1000™ ERS

automated ellipsoidal reflector spotlight

The VARI✻LITE® VL1000™ ERS luminaire combines the functionality of one of the most popular conventional lighting tools — the ellipsoidal reflector spotlight — with the versatility of an automated luminaire.

Automated functions include CYM color mixing, rotating gobos, variable diffusion, and a zoom lens that ranges from 19˚ to 36˚ for normal imaging and a super zoom function that ranges to 70˚.

Tungsten versions VL1000T, VL1000TI and VL1000TS deliver 10,000 lumens with the consistent color temperature of a tungsten source.

Models VL1000A, VL1000AI and VL1000AS deliver more than 15,000 lumens with the higher color temperature of the 575 watt arc source. These models also include a mechanical dimmer and a truss mounted, fanless ballast.

Models VL1000TS and VL1000AS include an automated, four-blade shutter mechanism that provides control of all shutter functions popular in conventional ellipsoidal reflector spotlights.

Models VL1000TI and VL1000AI include a beam size iris.

Programmable Functions

Zoom Optics:	Continuously variable field angle in imaging range from 19° to 36°, super zoom of field to 70° is programmable over a timed range of 2 seconds to 20 minutes.
Color Mixing:	A fully crossfading CYM color system is included.
Diffusion:	Field or gobo can be continuously and smoothly diffused to wash.
Rotating Gobo Wheel:	Six-position rotating gobo wheel with five rotatable, indexable gobo positions and one open position.
Shutter (Framing Models):	Four-blade system can frame and crop beam field and gobos. Each individual shutter is capable of translating to beam center while also rotating ±35°. Entire shutter rotates ±45°.
Beam Size Control (Iris Models):	In addition to the zoom optics, a mechanical iris provides continuous beam size control for both rapid changes and smooth timed beam angle changes.
Pan & Tilt:	Smooth, timed continuous motion using stepper motors with encoder correction. Pan range is 540°; tilt is 270°. Resolution is 0.1°. Unit will calibrate to support close hangs (yoke-to-yoke).

Description

Source:	1000 W Tungsten Halogen Lamp	Color Temp:	3200K
		Output:	10,000 Lumens
Source:	575 W Arc Lamp	Color Temp:	5600K
		CRI:	95
		Output:	>15,000 Lumens
Source:	575 W Long-Life Arc Lamp	Color Temp:	6000K
		CRI:	75
		Output:	>15,000 Lumens

Power Requirements:	Depending on voltage, 1 to 2 A are supplied to the Tungsten models through standard AC distribution while 3 to 9 A are supplied to the Arc luminaires and ballast.
Reflector:	Precision glass reflector with dichroic cold mirror coating.
Operational Temperature:	-20˚ to 122˚F (-29˚ to 50˚C).
Cooling:	Free convection cooling when hung. Floor mounted units and extreme ambient temperatures activate a low noise forced air cooling system.
Control:	Completely compatible with a wide variety of DMX-512 consoles.
Mounting Position:	The VL1000 ERS luminaire can be mounted and operated in any orientation.
Spacing:	Full range of motion on 26.5" centers. Hangs as close as 20.0".
Weight:	70 lbs (32 kg).

Accessories

71.2554.0100	1000 Watt Tungsten Lamp, 100 VAC
71.2554.0115	1000 Watt Tungsten Lamp, 115 VAC
71.2554.0230	1000 Watt Tungsten Lamp, 230 VAC
71.2528.0575	575 Watt Arc Lamp, MSR575HR
71.2556.0575	575 Watt Long-Life Arc Lamp, MSD575HR
41.6010.XXXX	Gobo, VL1000 (Specify pattern from catalog to complete P/N.)

VARI✻LITE®

Express yourself.

VL1000™ ERS

automated ellipsoidal reflector spotlight

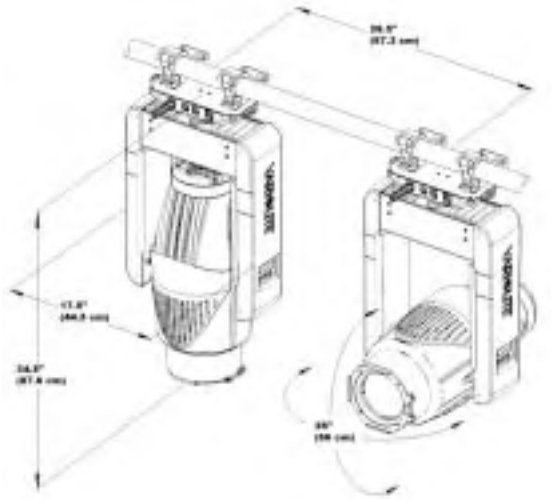
Photometric Data*

FIELD ANGLE (Degrees)	FIELD DIAMETER TN[1]	BEAM ANGLE (Degrees)	BEAM DIAMETER TN[1]	CANDELA (cd)
VL1000 ERS — 1000W Tungsten Halogen (100V Lamp)				
19.5	.344	14.5	.254	151,300
27.0	.480	20.0	.353	85,700
37.0	.669	26.5	.471	44,400
70.0 (Super Zoom)	1.40	30.0	.536	21,400
VL1000 ERS — 1000W Tungsten Halogen (115V Lamp)				
19.5	.344	14.5	.254	146,200
27.0	.480	20.0	.353	82,000
37.0	.669	27.0	.480	42,700
70.0 (Super Zoom)	1.40	31.0	.555	20,700
VL1000 ERS — 1000W Tungsten Halogen (230V Lamp)				
19.5	.344	14.0	.246	127,400
27.0	.480	20.0	.353	70,200
37.0	.669	26.5	.471	36,300
70.0 (Super Zoom)	1.40	30.5	.545	17,580
VL1000 ERS — 575W Metal Halide				
19.0	.335	13.0	.228	235,300
27.0	.480	18.0	.317	123,700
36.5	.660	24.0	.425	66,500
70.0 (Super Zoom)	1.40	28.5	.508	31,600
VL1000 ERS — 575W Metal Halide (Long-Life)				
19.5	.344	13.5	.237	205,400
27.0	.480	18.5	.326	104,900
36.0	.650	24.5	.434	56,400
70.0 (Super Zoom)	1.40	28.0	.499	27,000

* All data taken with seasoned light source at 20 hours of life.
[1] Multiply distance by Tn to determine coverage.
To calculate center beam Illuminance (I), at a specific distance (D): $I = \frac{cd}{D^2}$
— if (D) is in feet, (I) is in foot candles
— if (D) is in meters, (I) is in lux

Models

MODEL	PART NUMBER	SOURCE	FRAMING SHUTTERS	IRIS
VL1000 T	20.9663.0001.01	Tungsten	No	No
VL1000 TS	20.9663.0001.02	Tungsten	Yes	No
VL1000 TI	20.9663.0001.03	Tungsten	No	Yes
VL1000 A	20.9663.0001.11	Arc	No	No
VL1000 AS	20.9663.0001.12	Arc	Yes	No
VL1000 AI	20.9663.0001.13	Arc	No	Yes



Specifications

The unit is an integrally designed, remote-controlled, automated ellipsoidal reflector spot luminaire. An integral enclosure/pan tube supports the luminaire with provisions for two hooks. The pan tube serves as an interconnection point for power and data. Low noise fans provide forced-air cooling for internal components during extreme operating conditions. The rear cap provides three point lamp adjustment and easy access to the lamp for replacement.

A dimmed lamp power cable (for tungsten models), an AC input connector, and two, five-pin DMX-512 compatible connectors (in and through) are provided. The unit can be controlled by VARI✻LITE® consoles or a wide variety of DMX-512 consoles.

Each unit is equipped with a high-speed processor providing diagnostic and self-calibration functions as well as internal test routines and software update capabilities. A yoke arm mounted panel and display provide the user interface.

The unit contains independent stepper motors to provide movement of the head through 540° in the horizontal plane (pan) and 270° in the vertical plane (tilt). The luminaire calibrates so hanging distances may be minimized.

A zooming multi-element optical system provides continuous focus of gobo images for field angles from 19° to 36°. A super zoom function provides field angles to 70°. Independent control of edge is provided.

A CYM color mixing system is provided for a broad range of user color selection. A diffusion stage is included in the color system. This stage provides controlled reduction of the contrast ratio of imagery and beam edges. The effect is a continuous transition from spotlight to floodlight.

A six-position gobo wheel with five rotatable, indexable gobo positions and one open position is included. Gobos are easily installed and removed. (A wide selection of gobos is available from Vari-Lite.)

Framing shutter models contain four shutter blades that translate radially across the beam. Each individual shutter is capable of translating to beam center while also rotating ±35°. The framing shutter mechanism rotates as a unit ±45°.

Iris models contain a beam size iris suitable for producing narrow beams and cropping gobos. The unit is ETL and ETLc certified and CE marked. Exterior finish is black. Custom colors may be special ordered.

Vari-Lite, Inc.
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Dallas, TX 75247
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fax: 214.630.5867
www.vari-lite.com

VARI✻LITE®
Express yourself.

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07/02, 5M

SECTION 12353 - EXHIBIT CASEWORK

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this section shall be governed by the Contract Documents. Provide materials, labor, equipment, and services necessary to furnish, deliver, and install all work of this section as shown on the drawings, as specified herein, and/or as required by job conditions.

B. The Work of this Section includes all labor, materials, equipment and services necessary to complete the exhibition cases as shown on the drawings and/or specified herein:

1. Structural design of the exhibit casework metal frame, supported glazing, object support systems, and graphic panel supports by Contractor's Professional Engineer, including Building Department filing and testing requirements.

C. RELATED SECTIONS

Section 05500 - Metal Fabrication
Section 16500 - Exhibit Lighting

1.2 DOCUMENTATION

A. The Drawings (plans, elevations, and design details) and specifications are an outline of the criteria and performance requirements of the Work. It is recognized that the design details do not cover every condition. It is, however, intended that any conditions not detailed shall be developed through the Casework Contractor's shop drawings to the same level of aesthetics and functionality and in compliance with performance criteria, as indicated in detailed areas and stipulated in these specifications. The Casework Contractor, by accepting a contract for the Work, acknowledges this and agrees that the Exhibit Designer shall have the final say as to all matters whether detailed or not on the Drawings.

1.3 SUBMITTALS

D. Shop Drawings

1. Submit shop drawings to the Exhibit Designer for review in accordance with the requirements of the Contract Documents. Preliminary drawings must be submitted, approved, and revised prior to issue to Owner for sign-off and fabrication.

a. Structural Metal Frame drawings are to be submitted to Exhibit Designer and Structural Engineer for review and approval prior to fabrication.
b. Lighting details and layouts are to be provided to Exhibit Designer and Lighting Consultant for review and approval prior to fabrication.

2. Provide large scale plans, elevations, sections and details clearly showing the materials, thicknesses, dimensions and method of attachment to each other and to the encountered

conditions. Fastening devices whether concealed or exposed shall be noted as to size, type and spacing. Clearly indicate scale.

a. Note and describe the various materials and finishes including but not limited to structural materials, fire retardants, adhesives, paints, caulks, gasket material, graphic panels, shelves and decorative elements. Provide manufacturer name, address and complete product information including product name, color, and identifying number. Note how materials will be fastened to one another.
b. Joints which occur in the finished work shall be clearly identified and shall be subject to the Exhibit Designer's review.

3. Submit schedule of casework hardware, noting types, manufactures and finish.

4. It is the essence of this work that the casework shall accommodate object support system, graphic panels, lighting fixtures, and fittings where noted as necessary to provide a fully functioning Exhibit Case.

a. Clearly indicate these requirements on the submitted preliminary shop drawings, and note all work and items to be provided by other trades. Indicate materials used to construct and finish casework including the location of use, manufacturer, and product specifications including color and other finish numbers.
b. Provide isometric drawings showing access into the case structure for all required maintenance including access into the display chamber and the lighting power chamber. Clearly indicate access for graphic panels in each case as well as for the re-lamping of each fixture.
c. Provide final drawings that incorporate any required revisions. Fabrication to be based on approved final drawings.
d. Provide two copies of as-built package that includes as-built drawings and specifications for final construction and finish materials.

5. Indicate those items to be provided by others and those items which will be Not In Contract.

6. As a part of the preparation of Shop Drawings, Contractor shall retain a Professional Engineer, licensed in the State of Utah, to review and design the exhibit casework metal frames, supported glazing, object support systems, and graphic panel supports all as described in the Contract Documents.

a. Contractor’s Engineer shall supervise the design, review and sign and seal Shop Drawings, visit points of manufacture and construction, and submit all calculations and drawings to the Building Department as required. Contractor’s Engineer shall arrange and supervise all required testing needed for Building Department.
b. Casework systems shall conform to the Building Code, which references the International Building Code 2006 edition. IBC 2006 requires compliance with reference standard ASCE 7-05 with respect to seismic criteria for architectural components.
c. The casework frame systems are to accommodate the weight of artifact objects and exhibit displays in addition to its own self weight and the weight of supported glazing and lighting systems. The casework glazing is to accommodate the seismic deflections of its supporting frame and continue to be supported and retained by its frame during a Code specified seismic event.

E. Samples

1. Prior to purchasing bulk materials, and in advance of fabrication, the Contractor shall submit the following samples to the Exhibit Designer for approval:

   a. Three (3) pieces each of all fasteners, spring washers, threaded inserts, locks, levelers, gaskets, etc. which will be incorporated into the finished casework.
   b. Three (3) one-foot-square (12" x 12") sample of glass with finished edges and seals.
   c. Three (3) one-foot-square (12" x 12") sample of base panel finish

2. Prior to purchase and fabrication, all construction and finish materials must be tested and approved by the Owner's conservator. Material testing will require six weeks and the fabrication schedule must allow for the testing, as well as time for identification, testing, and approval of alternative materials. It is suggested that two or more potential options be provided for testing. Testing requires six (6) 5" x 7" or 5oz. samples of each material.

F. Prototypes:

1. One (1) prototype for complete assembly showing case access, finish, hardware including Object Support System, assembly and integration of all graphic panel types with all components for Display Chamber, and Lighting Power Chamber. In order to test the case performance and review all design details, the prototype must be built to the dimensions of the Case-type in the exhibit; if such a prototype is approved, it may be incorporated into the final exhibit, if indistinguishable from the remaining production run of Cases.

2. Contractor shall not proceed with fabrication of the component in question until the prototype is accepted based on its overall quality, function and appearance by the Owner and Exhibit Designer. Case must pass performance testing to assure proper functioning of case doors, integration with object support system, removable graphic panels and lighting. Adequate time for testing and adjustments must be built into the fabrication and installation schedule.

3. Contractor shall devise a timetable for fabrication and submittal of prototype so that a submittal and review process of reasonable duration shall have no adverse effect on project schedule. A four-month schedule from submittal of preliminary drawings to review of case prototypes is recommended. Up to one month may be required for final testing and revisions.

G. Product Literature:

1. For all manufactured items, e.g., casework hardware, submit manufacturers catalog cuts, literature, color charts, and data sheets along with other required submittals.

2. Submit fire retardant test data for panel cores.

H. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects/ Designers and Governments, and other information specified.

1.4 QUALITY ASSURANCES

I. The work shall be executed by a recognized casework shop who can furnish supporting evidence that the firm has been continuously employed for not less than ten (10) year's on projects of similar size and quality to that shown and specified and with adequate production capacity to produce the work without causing job delay.

J. Installer qualifications: Arrange for installation of exhibit case work by a firm that can demonstrate successful experience in installing exhibit case work similar in type and quality to those required for this project.

K. Conservation References: Contractor to meet National Museum of the American Indian Conservation Approved Exhibit Material Guidelines.

1.5 DELIVERY, STORAGE AND HANDLING

L. Conditioning: Installer shall advise Contractor of temperature and humidity requirements for casework installation areas. Do not install work until required temperature and relative humidity have been stabilized and will be maintained in installation areas. Fabrication and installation schedule must allow four weeks between the application of the last paint, sealant, or adhesive and the installation of any artifact or item.

M. Fully protect each item from the weather and from extremes in temperature and relative humidity while in transit from point of origin or fabrication to the job site. When delivered immediately place under cover and adequately protect from damage. Keep clean, and store and handle in such a manner as to avoid injury. Casework must be free from any defects in joint or seals that negatively impact the ability to maintain a conditioned environment within the case. Casework must be clean and free of all insects.

N. Deliver items from the point of origin with the original, approved manufacturers packing and wrapping. Removing of wrapping and packing materials shall occur in the final room or space only.

O. Remove delivered materials which do not conform to the reviewed samples or are damaged, marred or otherwise not suitable for installation from the job site and replace with acceptable materials.

P. Finished items shall be delivered to the job site ready for installation. Storage of finished items at the job site awaiting installation will not be permitted.

Q. Only limited repair of damaged materials can occur on site. Repair work especially that requiring painting, sanding, sawing or other dust or volatile producing work must be approved and may be restricted to a work area outside of the exhibit space.

1.6 WARRANTY

A. Contractor guarantees and warrants the completed work and components for one year from acceptance for any defects in materials or workmanship. Contractor shall promptly correct, at its

expense, any portion of the work not meeting industry standards or local building code requirements, or which fails or proves defective in whole or in part during the warranty period.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All construction and finish materials must be tested and approved for Conservation.

B. Metal: All exposed metal finishes for casework shall be tinted lacquered steel with finish to match building partitions. Also refer to Section 05500 Metal Fabrication for additional information.

C. Glazing: All glazing to be 17.5 mm. tempered annealed glass with ultraviolet radiation filtering laminate. ADD ALT glazing to be 17.5 mm. optiwhite laminated anti-bandit glass with ultraviolet radiation filtering laminate. Glass thickness to be reviewed by engineer to assure that glass will not bend or bow. Edges to be precision ground and polished.

D. In order to meet Conservation Guidelines, it is strongly recommended that the use of wood products be eliminated in the case interior. Use of aluminum, aluminum/polyethylene laminates, and rigid polyethylene foam is preferred. When wood is required, Medium or High Density Overlay (MDO Simpson Signal) plywood is preferred. Shall conform to ANSI A208.1. Density shall be not less than 40 lbs./cu. ft.

E. Concealed fastening clips in conjunction with casework interiors shall be extruded aluminum interlocking type and not less than 2 inches wide x .125 inches thick.

F. Paint: Case interiors shall only be painted with conservation-approved paint. No oil-base paints nor any other substances emitting formaldehyde, volatile acids, or other corrosive volatile organic compounds shall be used inside case environments. Use of other types of paint shall be subject to written approval by Exhibit Designer.

G. Epoxy Sealant: All wood used within case environments shall be sealed before covering with paint or fabric with two (2) coats of a paintable sealant approved by Owner’s Conservator and applied per Manufacturer's specifications.

H. Caulking: Select a neutral cure silicone caulk that does not emit acetic acid during cure. DowCorning neutral curing RTV silicone or equal, installed per Manufacturer's specifications.

I. Gaskets: Select an inert extruded silicon seal bonded to glass edges with neutral curing silicon adhesive, installed per Manufacturer's specifications. Door hinges and access panels must allow clearance for the gasket dimension. The density of the gasket is important, as is its location, continuity, and dimensions. When possible seat foam gaskets into a channel or through that measures 60% of the gasket’s depth. To prevent air leakage, it is critical that access doors and removable panels meet the following criteria:

1. Attach with enough fasteners in order to compress the gasket material

2. Do not bow or deform under the pressure of the fasteners

3. Seat evenly against a uniform gasket surface

4. Fit with continuous gasket with no gap between sections

5. Do not bind against the gasket along the hinged side.

J. Glue: Any adhesive used inside the case either in construction or application of finishes including graphic panels and photomurals must be approved by Owner's Conservator.

1. Fabric: Adhere using mechanical fastening methods, 3M#465 acrylic adhesive transfer tape, or approved equivalent.
2. Instabond C by Quality Mounting and Laminating Systems, Inc. is pre- approved as an interior case adhesive. This can be used for prints, graphics or text panels.

K. Rough Hardware (concealed from view)

1. Nails shall be common steel wire, untreated for interlock work as per FS FF-N-1 05. Finishing type at countersunk face locations for concealment.

2. Bolts shall be standard mild steel, square head machine bolts with square nuts and malleable iron and steel plate washers or carriage bolts with square nuts and cut washers conforming to the following:

   a. Bolts FS FF-B-575 and 584
   b. Nuts ASTM A-563
   c. Expansion shields FS FF-B-561
   d. Toggle bolts FS FF-B-588
   e. Lag screws and bolts ANSI B18.2.1

3. Wood screws as per ANSI B18.6.1.

4. All concealed wood must be coated with two applications of a Owner's Conservator approved coating.

2.2 SLIDING PANELS

1. Each glass panel shall have one upper and one lower track. Electronic actuators are to provide the main case locking with additional mechanical locks at the bottom of the case. After unlocking the panel from the closed position, each panel shall move forward to clear the ends of the exhibition case, and then be able to be moved sideways on its tracks. Movement shall be in both directions to enable 60% of the case to be accessible in each direction.

2. Provide locking devices at all components to maintain cases secure. Provide devices with minimum visual appearance at exposed portions.

3. Operable panels and track support mechanisms shall be integral parts of exhibition cases. Each operable panel shall be supported sufficiently to eliminate sag and drag or binding in

operation, by a minimum of four hardened steel rods, in bearing pillow blocks.

2.3 CASEWORK FABRICATION

L. General: all work shall be shop fabricated and delivered to the job site ready for installation.

M. Casework shall be constructed so that no wood framing is exposed to the display chamber or the environmental chamber. Paints or sealers shall not be considered as preventing exposure.

N. Case Interiors: Interior Finished Panels including graphic railing specified under Exhibit Fabrication Scope constructed with materials approved by Smithsonian Institution.

O. Casework shall integrate Air Pressurization (Fantech) and Smoke Detection (Vesda) Systems supplied by General Contractor. Coordination and installation of Mechanical Air Inlets and Vesda Sample ports are the responsibility of the Exhibit Contractor. See Responsibility Matrix in Section 01125 for further details.

2.4 CASEWORK CONSERVATION REQUIREMENTS:

P. CONSTRUCTION:

1. Physical stability: provide structural stability to withstand shock and vibration (from visitor movement, HVAC system, and other equipment)

2. Exhibit case should protect their content from fire exposure for at least 30 minutes and the force from overhead sprinklers and fire department hoses.

3. Precise fitting of construction joints are necessary to create a dust free, insect-excluding display chamber that can be maintained to a target relative humidity using silica gel. Seal all seams and joints that could allow the exchange of air between the display/ maintenance chamber and the ambient air outside of the case including doors into the maintenance and display chambers, gaps between glass panels, seams between display and lighting chambers, access holes for fiber optic or other lighting fixtures, and access points for audiovisual equipment. Access to all equipment must be provided in such a way that the display chamber is not affected.

4. All Cases shall be constructed to allow only inert or acid-free materials to come in contact with historic textiles, documents, and other sensitive organic materials and artifacts.

5. Provide easy access to objects in display chamber for rotation of objects.

6. Provide easy access to lighting equipment for maintenance.

7. Design, build, and finish the display and lighting chamber of the case to limit the air exchange between the case interior and the ambient air in the exhibit gallery. Use leak detection equipment to identify leaks and seal using conservation-approved methods. Test each case after installation to confirm seal.

Q. TEMPERATURE AND HUMIDITY CONTROL

1. Casework needs to be sealed to buffer changes in temperature and relative humidity; and to maintain a Specific Relative Humidity; Museum Exhibit Areas are designed to maintain a temperature of 70˚F and a Relative Humidity of 45%, maintained 24hrs a day and 365 days a year. Daily fluctuations must not exceed 5% RH. Design and construct exhibit cases to maintain a target relative humidity with no more than a total of 8% variation in relative humidity per 24 hours and a rise in temperature of no more than 2°F even when the case is lit or any equipment is operational.

2. E.F. to coordinate with G.C. to ensure proper functioning of the mechanical damper to cut off unconditioned air from entering into the Exhibit Case in the event of HVAC failure.

3. E.F. to provide one (1) "Arten Thermo/Hygrometer" or approved equal per Exhibit Case to measure and monitor relative humidity as per Smithsonian specification.

4. Lighting chamber must be physically sealed from the display chamber with any access points sealed with gaskets or caulk. Heat from any equipment including lamps and audiovisual equipment must not rise the case temperature more than 2°F. Mechanical fans or other system may be required to dissipate heat.

R. DUST CONTROL AND FILTRATION:

1. Casework to allow for integration of General Contractor provided air filtration system above case. Coordinate with General Contractor to insure mechanical air and three part filtration system for casework is provided above each case. Install (Fantech) air inlet on top of case as described in Contract Documents.

2. Provide adequate seal and rate of air exchange between case interior and exterior

3. Use leak detection equipment to identify leaks and air exchange rate.

S. SECURITY:

1. Case closure system to include locking panel at each Interactive Station and Master Control Board at the Study Center.

2. Use shatterproof laminated glazing

3. Use tamper -resistant hardware for all concealed case screws and entry hardware.

4. Conceal all entry hardware.

PART 3 PART - EXECUTION

3.1 EXAMINATION

A. Study the Contract drawings and specifications with regard to the work as shown and required

under this Section so as to insure its completeness.

B. Examine surfaces and conditions to which this work is to be attached or applied and notify the Exhibit if conditions exist which are detrimental to the proper and expeditious installation of the work. Starting on the work shall imply acceptance of the surfaces and conditions to perform the work as specified.

C. Verify dimensions taken at the job site those affecting the work. Bring field dimensions which are at variance to the attention of the Exhibit. Obtain decision regarding corrective measures before the start of installation.

D. Cooperate in the coordination and scheduling of the work of this Section with the work of other Sections so as not to delay job progress.

E. Consult with Exhibit Designer and Smithsonian Institution on case design, materials selection and testing, and case performance testing.

3.2 INSTALLATION - GENERAL

F. Perform installation using skilled workers who are familiar with this type of work. The manufacturer shall provide the services of a direct manufacturers representative in the field to assure that the work is being performed in a manner recommended.

G. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims in a manner that will prevent any future warping, cracking, settling or other distortion. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including shelves); and with 1/16" maximum offset in flush adjoining surface, 1/8" maximum offsets in revealed adjoining surfaces.

H. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

I. Accurately locate each item at its designated location and anchored in place in a secure and plumb manner, using the methods and means noted on the reviewed submittals.

J. The climatological conditions at the job site shall be equal to the conditions under which the work was fabricated. Do not store or install the work when the temperature and humidity are above or below accepted limits, as determined by the manufacturer and/or the Designer.

1. Defects which occur as a result of the above shall be repaired and/or replaced, as determined by the Exhibit Designer, and at no additional cost.

K. Cabinetwork – Casework

1. Carefully unpack each item near its point of installation. Loose parts and accessory items shall be set within the furniture at their designated locations.

2. Install without distortion so that doors and panels will fit openings properly and be securely aligned. Adjust hardware to center doors and drawers in openings and provide

unencumbered operation. Complete the installation of hardware and accessory items as indicated.

3. As each item is set the leveling devices shall be adjusted so that its top is plumb and level, and tested so it does not sway, rock or shake.

4. Ceiling hung casework shall be anchored to the underside of supporting components in a rigid, plumb and secure manner. Method of attachment must not compromise seal of case display and maintenance chambers. Adjacent hung ceiling provided by General Contractor should be protected from damage during install. Coordinate Casework details with hung ceiling transitional elements.

5. Prior to acceptance, operating hardware shall be checked and adjusted. Hardware shall operate smoothly for use intended. In the closed position the space between the moving portion and the fixed shall be uniform, even and plumb, and flush with the abutting surface. Doors in their open position should allow case access of no less than 60% of the doors width.

6. Provide a closeout package including as-built drawings, tools and keys for case entry, manual for AV controlled door access, extra material, touch up kit with paint, fabric and other finish materials.

3.3 PROTECTION AND CLEANING

A. Protect installed case work at all times, by adequate and suitable means, during and after installation and until accepted. The site must be dust free and clear of other trades prior to and during casework installation. Once cases are installed the area should be secured and Permission to Work permits should be issued to prevent damage to cases by following trades.

B. Surfaces which become damaged, marred, scratched, abraded or are not sound and are defective functionally or visually shall be repaired and/or removed and replaced, as determined at no additional cost.

C. Clean all surfaces of grime, dust and general construction dirt. Touch-up shop-applied finishes to restore damaged or soiled areas.

D. Clean hardware, lubricate and make final adjustments for proper operation.

END OF SECTION

SECTION 16500 – EXHIBIT LIGHTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Applicable requirements of the Contract Documents and of Division I and General Requirements of the Specifications apply to the work of this Section.

1.2 SCOPE

A. Included in the work of this Section are labor, materials and appurtenances required to complete the work of this Section, as specified herein, as required by job conditions, or as indicated on drawings, including but not limited to general requirements for lighting fixtures including coordination, definitions, quality assurances, submittals, mockup, samples and general responsibility for a complete job.

1.3 DEFINITIONS

A. In this specification, the term “Architect” includes the Architect, Owner's representative and/or the Lighting Consultant, together or individually as they shall decide. The term “fixtures” refers to lighting fixtures and luminaires.

1.4 GENERAL REQUIREMENTS

A. Provide labor, materials, and equipment for the installation of indoor and outdoor lighting fixtures, lighting equipment, and lamps as shown on the drawings and specified here.

B. Refer to drawings for dimensions and details. Check and verify dimensions and details on drawings before proceeding with the work. Report any discrepancies at once to the Architect. Should it appear that the work intended is not sufficiently detailed or explained on the drawings or in the specifications, apply to the Architect for further drawings or explanations, as may be necessary. Conform to these explanations in the work. If any question arises about the true meaning of the drawings or specifications, refer the matter to the Architect whose decision is final and conclusive. In no case submit a bid, or proceed on any work with uncertainty. The intention of this specification and the accompanying or applicable drawings is to provide a job complete in every respect. Contractor is responsible for this result.

1.5 COORDINATION

A. Clearly indicate the Work to be performed by other trades contractors, and the materials that are adjacent to or abutting the Work of this Section. Coordinate as required.

B. Fixture locations as indicated on the electrical drawings are generalized and approximate. Carefully verify locations with Architect's plans, reflected ceiling plans and other reference data prior to installation. Check for adequacy of headroom and non-interference with other equipment, such as ducts, pipes or openings. Bring conflicts to the Architect's attention before proceeding with the work.

C. Give ample notice of special openings required for placing equipment in the building, in order to avoid cutting of completed work.

D. Furnish the materials and labor for Work included under this Section in ample time, and in sufficient quantities so that all of the Work may be installed in proper sequence to avoid unnecessary cutting of the floors and walls.

E. Co-ordinate and schedule the Work of this Section with the Work of other Sections, Utility Companies and the Telephone Company so that there shall be no delay in the proper installation and completion of any part of each respective Work. Construction Work shall proceed in its natural sequence without unnecessary delay caused by the Work of this Section.

F. Schedule the Work to prevent Work of this Section being damaged by other construction operations. Remove and replace Work so damaged at no cost to Owner.

G. Where Work of this Section is to be flush or concealed, install it to assure that it does not project beyond the finished lines of floors, ceilings or walls.

H. Although the location of equipment included in the Work of this Section may be shown on the Contract Drawings in a certain place, actual construction may disclose that the location for the Work does not make its position easily and quickly accessible. In such cases, call the Architect's attention to this situation before installing this Work, and comply with his installation instructions.

I. Verify mounting conditions for all fixtures, and furnish appropriate mounting details upon request. Such mounting details shall be approved by Architect.

1.6 QUALITY ASSURANCES

A. Acceptable manufacturers are listed in the fixture descriptions. Acceptable manufacturers shall be prepared to provide, upon request, proof of satisfactory production of equal or similar fixtures for a period of at least five years prior to bidding.

B. Statement of Application

1. The Contractor, by commencing the Work of this Section, assumes overall responsibility, as a part of the warranty of the Work, to assure that assemblies, components and parts shown or required by the Work of this Section comply with the Contract Documents.

2. Required Warranty

a. For a period of one year after Owner's initial acceptance and establishment of the beginning date of the warranty period, and at no additional cost, the Contractor shall promptly provide and install replacements for fixtures or components (except for lamps) which, in the opinion of the Owner, are defective in materials or workmanship under normal operating conditions. If approved to do so by the Owner, the Contractor may repair installed equipment at the job site to Owner's satisfaction, provided that the Contractor repairs any damage to adjacent Work. For any time during the warranty period that fixtures are not fully functional due to defects in materials or workmanship, the Contractor shall provide or pay for and install and remove suitable and adequate temporary lighting fixtures. The Contractor also warrants replacement fixtures or components to be free of defects in workmanship or materials for a period of one year

following replacement, and shall replace any defective replacements during their warranty period.

b. The Contractor shall not be held responsible for acts of vandalism or for abnormal or accidental abuse of the fixtures or their components occurring during the warranty period, nor shall the Contractor be held responsible for deleterious effects caused by maintenance procedures performed without the concurrence of Contractor.

C. Substitutions

1. Fixtures included under this Section are specified by approved manufacturer and type. Furn ish equipment as specified, unless substitutions are mutually agreed upon, as follows.

2. During the construction period, no substitutions shall be considered unless compelling reaso ns are given, such as inability to meet delivery schedule. This reason shall not be acceptab le if delay is caused by Contractor's failure to order fixture in accordance with the schedule p resented under “SUBMITTALS” below. In such cases, it is Contractor's responsibility to prov ide fixtures as specified without delay to the project and without additional cost to Owner.

3. Substitutions shall be named, samples, catalogue cuts and complete photometric reports submitted, and cost savings documented. Each substitution requested shall be submitted in the form of an alternate, separate proposal, accompanied by complete descriptive and technical data, indicating addition or deduction from the base bid. Submit a written request for proposed fixtures to be substituted to Architect at least two weeks prior to the bid period. Substitutions proposed less than two weeks prior to the bid submittal date, and/or not including proper documentation, shall not be considered. The Owner shall accept or reject proposed substitutions.

4. The Architect may request samples of fixtures proposed as substitutions by the Contractor. Samples shall be submitted in accordance with Section 1.08. Submit complete and operable sample fixtures for any proposed substitution as indicated in 1.06.C. above. Substitution samples provided to the Architect less than one week prior to the bid submittal date, and/or not including proper documentation, shall not be considered.

5. Where proposed substitutions alter the function or appearance, or change space requirements or mounting details indicated in the Contract Documents, the Contractor shall detail such changes in the proposal and include costs for revised design and construction for trades involved.

6. In the case of "package" substitutions exceeding 10% of the fixture types included in this Specification, the Contractor shall reimburse the Architect and consultants for the cost of evaluating proposed substitutions, whether or not such substitutions are accepted.

D. Equipment Compatibility: For each group of similar fixture types provide fixtures and components fabricated by one manufacturer, to simplify maintenance and replacement of equipment.

E. Regulatory Agencies

1. Provide fixtures constructed, wired and installed in compliance with the current edition of applicable city, state and national codes. Provide fixtures conforming to Underwriters

Laboratories Standards, and to provisions of applicable codes which exceed those standards. In addition, provide fixtures which conform to additional regulations necessary to obtain approval for use of specified fixtures in locations shown. Use only electrical components listed by Underwriters Laboratories.

2. Particular attention is called to Article 410 (Lighting Fixtures) of the National Electric Code. Provide only fixtures that meet these requirements, as interpreted by local agencies. As manufacturers' catalogue numbers may not include thermal protection devices, it is Contractor's responsibility to co-ordinate the fixture provided with the ceiling construction in accordance with local code enforcement practice.

F. Recognized Standards

1. Underwriters Laboratories (UL)
2. National Electrical Code (NEC)
3. Certified Ballast Manufacturers Association (CBM)
4. Illuminating Engineering Society (IES)
5. American Society for Testing and Materials (ASTM)
6. American National Standards Institute (ANSI)

1.7 SUBMITTALS

A. Shop drawings, samples, test data and certificates shall be submitted for approval in accordance with the requirements of the Contract Documents. Fixtures or other materials shall not be shipped, stored or installed into the work unless prior approval has been received, based upon the submittal of shop drawings, samples, catalogue cuts, test data, certificates or other material submitted for approval. Make modifications to fixtures in accordance with Architect's comments concerning submittals, as a part of the work of this Section.

B. Submittal Schedule

1. Within 90 calendar days after award of General Contract, a List of Intended Manufacturers a nd estimated fabrication lead times shall be submitted to Architect. Lead times shall be mea sured in weeks, beginning from the manufacturer's receipt of approved shop drawings and r elease, and ending at shipment. Architect shall approve or disapprove each manufacturer.

2. Within 30 days after Contractor's receipt of Architect's response to the List of Intended Manu facturers, copies of purchase orders and manufacturers' acknowledgments for all fixtures sp ecified, conforming to Architect's responses, shall be forwarded to Architect. The purchase orders and the manufacture acknowledgments need not list prices, but shall contain a warra nted fabrication lead time, in weeks, as defined above. These fabrication times shall be ade quate for the timely completion of the job.

3. Within 30 days after date of manufacturer's acknowledgment of order, Contractor shall forwa rd to Architect complete shop drawings, and/or catalogue cuts for all specified fixtures.

4. Within 15 days after Contractor's receipt of disapproved shop drawings, revised shop drawin gs shall be resubmitted to Architect.

5. Within 15 days after receipt of “approved” or “approved as noted” shop drawings, Contractor shall forward to Architect a warranted shipment date for each specified fixture, as well as forwarding samples, texts, or any outstanding data required for approval.

6. The Contractor shall call to the attention of the Architect any submittals that have not been returned to him in a timely manner and that might effect the appropriate delivery of fixtures.

C. Shop Drawings

1. Submit shop drawings for each type of fixture, except where specified fixtures are standard, unmodified, off-the-shelf units, fully described by catalogue cuts. If allowed by Architect, such catalogue cuts may be substituted for shop drawings. Submit shop drawings in the form of one (1) reproducible and four (4) prints, or catalogue sheets in nine (9) copies

2. Indicate on shop drawings, materials, finishes, metal gauges, overall and detail dimensions, sizes, electrical and mechanical connections, fasteners, welds, joints, end conditions, provisions for the work of others, and similar information. Include pertinent mounting details including hung ceiling construction. Indicate complete details of the fixture, including manufacturer's catalogue numbers for sockets, ballasts, light shields, switches and type of wiring, and targeting and locking devices for adjustable fixtures. Indicate type and extent of approved inert insulating materials to prevent electrolytic corrosion at junctions of dissimilar metals shall be supplemented by additional drawings if information or descriptions listed above are not included in the sheets.

D. Submit independent laboratory photometric data in the directed number of copies and in format as directed by the Architect. Photometric data shall be submitted for standard, off-the-shelf units, at the time the manufacturer's cuts are submitted. Photometric testing and reporting shall conform to IES procedures.

E. Manufacturer's catalogue sheets shall indicate input and load electrical characteristics, ambient temperature rating, noise level rating, mounting methods and UL listing for use with required lamp.

F. Fluorescent fixture manufacturer shall submit, when requested to do so, (with fixture shop drawing or Catalogue Sheet) thermal test data for the fixture to prove that nuisance tripping of the Class P ballast shall not occur when fixture is operating under the following conditions:

1. Voltage not exceeding 5% above nominal line voltage.
2. Room ambient of 77 degrees Fahrenheit. (25 degrees Celsius).
3. Maximum ceiling cavity ambient temperature for recessed installation not exceeding 113 degrees Fahrenheit. (45 degrees Celsius).

1.8 SAMPLES

A. When samples are specifically called for in the Fixture Descriptions in this Section, submit (1) sample unless otherwise indicated. If fixture samples are requested, supply a completely operable fixture with a plug for standard 120 Volt service. Otherwise provide component parts as specifically requested.

B. In addition to the above, after shop drawings, data and any other required submissions have been approved, submit to Architect a sample of one of the following components.

1. Each incandescent or HID downlight reflector cone that differs in size or finish.
2. Finish samples of any custom color or finish requested by Architect.

C. Where a sample is submitted or requested, do not fabricate that fixture type until the sample is approved. Submit and resubmit a sample as specified in the Fixture Descriptions, as required, until samples are approved.

D. Tag samples with the name of the project, referenced specification, paragraph or drawing number, the fixture type number and any other identifying data. Ship the sample to the address specified by Architect. After review, the sample shall be shipped to the Architect at the project site for use as a comparison standard. All transportation charges for samples shall be paid by the Contractor. Make fixtures supplied under the work of this Section identical with approved samples. Do not install any sample fixtures in the project.

1.9 MOCK-UP

A. As a part of the work of this Section, where specifically called for in the Fixture Descriptions below, and at no additional cost to Owner, temporarily install, connect and adjust a reasonable number (3) of fixtures of each type specifying a mock-up, to verify specified requirements. Place the mock-up fixtures where and when directed by Architect. Removal and storage of mock-up fixtures, when approved, shall be accomplished by the Contractor.

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Lighting fixtures and their component elements shall be delivered to the job site factory-assembled and wired to the greatest extent practical, in strict accordance with the approved shop drawings, samples, certificates and catalogue cuts, and shall be handled in a careful manner to avoid damage.

B. Exposed finishes shall be protected during manufacture, transport, storage and handling. Delivered materials shall be identical to the approved samples. Materials which become damaged shall be repaired and/or replaced as directed.

C. Fixtures shall be stored under cover, above the ground, in clean, dry areas, and shall be tagged and/or marked as to type and location.

D. Delivered fixtures shall include wiring, sockets, ballasts, shielding, channels, lenses and other parts and appurtenances necessary for fixture installation of each fixture type.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide materials, equipment, appurtenances and workmanship for the work of this Section conforming to the highest commercial standards, as specified and indicated on the drawings. Make fixture parts and components not specifically identified or indicated on the drawings, of materials most appropriate to their use or function, and resistant to corrosion and to thermal and mechanical stresses encountered in the normal application and function of the fixtures.

B. Provide recessed fixtures that are constructed to be suitable for and compatible with the ceiling, wall or pavement materials and construction in which they will be installed.

2.2 MARKING OF FIXTURES

A. Plainly mark fixtures equipped with ballasts for operation of rapid start lamps “Use Rapid Start Lamps Only”. Similarly, mark other fixtures according to proper lamp type. Clearly mark ballasts that have multi-level outputs as such, and indicate proper terminals for the various outputs. Provide markings that are clear and that are located to be readily visible to service personnel, but invisible from normal viewing angles when lamps are in place.

2.3 MATERIALS AND FABRICATION

A. Unless otherwise noted, use only completely concealed hardware. Weld exposed metal at joints, fill with weld material, grind smooth, and make free from light leaks by the inherent design of the fixture body and frame. Bond gaskets, when used, to the fixture metal. Gasket incandescent fixtures with overlapping trim. Weld ballast support studs, socket saddle studs and reflector support studs to fixture body. Self-threading screws are not approved. Make flexible leads enter fixtures at sides, unless otherwise noted. Ventilate ballast compartments and fixtures using bottom relamping, unless otherwise noted.

C. Fixture components shall be constructed of minimum 22 gauge sheet steel unless otherwise specified.

D. Construct fixtures with the minimum number of joints. Make unexposed joints by approved method such as welding, brazing, screwing or bolting. Soldered joints are not acceptable. Do not use self-tapping methods or rivets for fastening parts which shall be removed to gain access to electrical components requiring service or replacement, or for fastening any electrical components or their supports.

E. Provide metallic cast or extruded parts of fixtures that are close grained, sound, and free from imperfections or discoloration. Provide cast or extruded parts that are rigid, true to pattern, and of ample weight and thickness. Provide cast or extruded parts that are properly fitted, filed, ground, buffed and chased to provide finished surfaces and joints free of imperfections. Make thickness on cast parts not less than 1/8 inch.

F. Provide housings for discharge lamps (fluorescent, HID) fixtures that make electrical components easily accessible and replaceable, without removing the fixture body from its mounting.

2.4 FINISHES

A. Apply fixture finishes after fabrication in a manner that assures a durable wear-resistant surfacing. Prior to finishing, hot clean the surfaces by accepted chemical means, and treat them with corrosion inhibiting (phosphating) treatment to assure positive paint-adhesion. Give exposed metal surfaces (brass, bronze, aluminum and others) and finished castings except chromium-plated or stainless steel parts an even coat of high grade methacrylate lacquer, or transparent epoxy. Anodize exposed aluminum surfaces for corrosion resistance. Make sheet steel fixture housing, and iron and steel parts which have not received phosphating treatment, or which are to be utilized in exterior applications corrosion resistant by zinc or cadmium plating or hot-dip zinc galvanizing after completion of all forming, welding, or drilling operations. Provide minimum thickness of protective coatings:

1. Hot galvanized zinc coating .0005 inch

2. Cadmium plating .00015 inch

B. Electroplate parts operated under temperatures injurious to hot-dipped galvanizing.

C. Cadmium plate screws, bolts, nuts and other fastening or latching hardware.

D. Except where otherwise indicated provide fixtures with a final synthetic, high-temperature baked enamel coating of color and finish as specified or directed. Unless otherwise specified, provide white baked enamel reflective surfaces, with a minimum reflectance of 86%. Unless otherwise specified, provide matte black non-reflective surfaces. Prior to painting give all parts proper etched surface preparation to assure paint adherence and durability. See paragraphs above.

2.5 FIXTURE WIRING

A. Provide wiring between fluorescent lamp holders and associated operating and starting equipment of similar or heavier gauge than the leads furnished with the approved types of ballasts and having equal or better insulating and heat resisting characteristics. Provide internal wiring of fixtures containing a minimum number of splices. Make splices with approved mechanical insulated steel spring type connectors, suitable for the temperature and voltage conditions to which the splices are to be subjected.

B. Make connections of wires to terminals of lamp holders and other accessories in a neat and workmanlike manner and which are electrically and mechanically secure, with no loose strands protruding. Provide a number of wires extending to or from the terminals of a lamp holder or other accessory that does not exceed the number which the accessory is designed to accommodate.

C. Provide wiring channels and wireways free from projections and rough or sharp edges throughout. At points or edges over which conductors shall pass and may be subject to injury or wear, round bush to make a smooth contact surface with the conductors.

D. Install insulated bushings at points of entrances and exit of flexible wiring.

2.6 BALLASTS

A. Provide ballasts for fluorescent lamps that are suitable for the electrical characteristics of the supply circuits to which they are to be connected, and which are suitable for operating the specified lamps. Provide ballasts which, unless specifically indicated to the contrary, have the following characteristics:

1. Electronic rapid start
2. power factor $\geq$ .90
3. ballast factor $\geq$ .90
4. total harmonic distortion $\leq$ 10%
5. lamp current crest factor $\leq$ 1.7
6. UL Class P
7. Sound Rating A.

8. Multi-lamp rapid start ballasts shall be of the series sequence type.

B. Provide ballasts conforming to UL, and ANSI specifications and displaying labels or symbols of approval by the UL, and of certification by the CBM. Design, fabricate and assemble component parts of ballasts in accordance with the latest requirements of the NEC. Mark ballasts “Class P” indicating approved integral ballast protection. This ballast protection is provided by a built-in self-resetting thermally actuated device that will remove the ballast from line when excessive ballast temperature is reached. See 1.07.F regarding nuisance tripping test data.

C. Rigidly mount ballasts, unless specifically indicated to the contrary, to the inside of the top of the fixture housing, with ballast surfaces and housing in complete contact for efficient conduction of ballast heat. Permanently affix ballast mounting screws to the fixture housing. Provide only fixtures whose design, fabrication, and assembly prevent overheating or cycling of lamps and ballasts under any condition of use.

D. Provide identical ballasts within each fixture type.

E. Provide ballasts having the lowest sound-rating available for the lamps specified and clearly showing their respective sound ratings. Replace ballasts found by Architect or Engineer to be unduly noisy, without charge, prior to acceptance of the job. Inform Architect in writing if ballasts with a sound rating other than A are to be provided.

F. For outdoor use and wherever ballasts are used outside a heated environment provide fluorescent ballasts capable of lamp-starting at any temperature down to 0 degrees F.

G. Approved Ballast Manufacturers

1. Magnetic:
   Advance
   General Electric
   Universal

2. Electronic:
   Advance
   Aromat
   Universal
   Energy Savings, Inc.
   Osram Sylvania

H. Ballasts shall have a 5-year warranty from date of acceptance of the completed installation.

2.7 LAMP HOLDERS

A. Provide incandescent and HID lamp sockets with porcelain housings over copper screw shells, with medium base sockets rated at 660W. Plastic or metal sheet sockets are not approved.

B. Provide fluorescent fixture sockets that are white, of heat resistant plastic and rated at 660W. Fluorescent lamp sockets operating with an open circuit voltage in excess of 300 volts shall be of the safety type which open the supply circuit when the lamp is removed from the sockets.

C. Rigidly and securely attach lamp holding sockets to the fixture enclosure or husk.

D. Where pull-chains are included, provide an insulating joint.

E. Provide sockets suitable for specified lamps, and set to position the lamps in optically correct spacing and relationship to lenses, reflectors, filters, and baffles.

2.8 LAMPS

A. Provide electric lamps as required, during construction, including lamps for fixtures furnished by others.

B. Provide a complete set of new lamps, as specified in Fixture Descriptions below, in each fixture, at the completion of the Work, leaving fixtures and lighting equipment completely lamped and/or in normal operating condition.

C. Unless specified otherwise, provide lamps as follows:

1. For 4' fluorescent fixtures provide 32 watt T8 type, which deliver not less than 2,900 initial lu mens for straight lamps, with 3,500°K correlated color temperature, unless otherwise indicat ed.
2. For incandescent fixtures provide inside-
frosted, 130 volt lamps unless otherwise indicated. For tubular quartz lamps provide frost ed, unless otherwise indicated. General use Type A or PS lamps located in service area sh all be rated at 2500hoursor greater lamp life. Unless otherwise specified, incandescentlamp scontaining a series connected diode either as an integral part of thelamp, or as a button ins erted into the socket are not acceptable.
3. For other fixtures, provide lamps as specified, or if not specified,as rated by the manufacture r. If specification is not complete, contact Architect for clarification.

D. The following lamp manufacturers are approved:

1. General Electric
2. Philips
3. Osram Sylvania
4. Venture
5. Ushio

2.9 REFLECTORS

A. Aluminum Reflectors

1. Provide reflectors and reflecting cones or baffles fabricated from #12 aluminum reflector sheet, .057 inch (15 gauge) or heavier; and absolutely free of tooling marks including spinning lines, and free of marks or indentation caused by riveting or other assembly techniques. No rivets, springs, or other hardware shall be visible after installation.

2. Provide reflectors and baffles of first-quality polished, buffed and anodized finish, Alzak or approved equal, and with specular finish color as selected by Architect. Provide reflector and baffles which produce no apparent brightness from nadir to 45 degrees above nadir, nor a lamp image nor may any part of the lamp be visible from nadir to 45 degrees above nadir.

3. Provide other aluminum reflectors where required, and formed and finished as noted on drawings and elsewhere in the specifications. Provide only reflectors free from blemishes, scratches, or indentations which would distort their reflective function and finished by means of the Alzak process, or approved equal, unless otherwise noted. techniques. No rivets, springs, or other hardware shall be visible after installation.

4. Aluminum Reflector Characteristics :

Class	Min. Coating Weight (mg/sq.in.)	Service	Min. Reflectivity (%) Specular/Diffuse
MI	5.0	Normal interior service.	83 / 75
SI	7.5	Medium service, interior industrial, exterior when operating within glass, metal, or plastic enclosure.	82 / 73
SE	10.0	Exterior industrial or commercial service, exposed to atmosphere. Marine service in enclosure.	78 / 65

B. Painted Reflectors

1. Provide painted reflectors completely formed before application of primer and enamel color coat or coats. Make reflectors and reflectorbodies for fluorescent lamp fixtures, having bake d-
on white synthetic enamel finish, of steel, of the thickness specified or noted and given a suit able primer and white color coat or coats,applied to meet the following requirements and tes ts described below.

2. When requested by Architect, submit a sufficient quantity of flat steel panels having the identical primer and color coat or coats applied in the same manners as proposed for the contract items, for subjection to any one or all of the tests listed herein by an approved independent testing laboratory. Provide panels of suitable size and drilled as necessary for a particular test procedure.

3. Tests will be required only in case of dispute about reflector characteristics. Tests may be required at any time before or during Contractor's guarantee period. Contractor will pay the cost of tests, if required. Reflectors which do not meet the criteria expressed here will be replaced at Contractor's expense, with reflectors meeting specified requirements.

4. Tests

a. Provide an initial reflection factor not less than 86%. After 100 hours exposure to a fade-o-meter, reflection factor may not be less than 85%, and finish can show no visible color change.

b. Specular Gloss, in accordance with ASTM Method D-523-T, Procedure A, may be a minimum of 80.

c. Exposure for 48 hours to either hydrogen sulfide or sulfur dioxide may cause no more than slight yellowing and no blistering.

d. A spot test with 5% potassium hydroxide at room temperature for four hours may show no effect other than a loss of not over 15% gloss.

e. Contact with 5% soda ash solution at room temperature for 24 hours may show no effect.

f. Exposure to 100% humidity at 100 degrees F., for 100 hours (Cook Box Test) may show no blistering or other effects.

g. Salt spray (20% sodium chloride) for 150 hours may cause no breakdown of film. Talbor Abrasion Test may show no more than 15 mg. per 300 cycles, using CS-10 wheel.

h. Erickson Bump Test may show a minimum of 3 millimeters of penetration before cracking.

i. Sward Harness Test may show a minimum of 30.

2.10 LENSES / FACE PLATES / TRIM

A. Where plastic lenses are indicated, provide lenses of virgin methyl methacrylate, unless otherwise indicated.

B. Make lenses, louvers, or other light diffusing elements contained in frames removable, but positively held within the frames so that hinging or other motion of the frame will not cause the diffusing element to drop out.

C. Provide face plates of incandescent recessed fixtures which open for access to the interior of the fixture, serve as a ceiling trim, and are positively held to the fixture body by adjustable means that permit the face plate to be drawn up to the ceiling as tight as necessary to insure complete contact of face plate with ceiling surrounding the fixture.

2.11 FIXTURE DESCRIPTIONS

A. Provide fixtures which conform to the above standards and criteria, as indicated on the drawings, and as indicated below. Contractor to verify ceiling conditions for all fixture types.

B. Catalogue or series numbers, when shown, are intended to provide assistance in establishing general type or category of lighting fixtures. These are not part of specification nor are they to be

used to order fixtures. Contractor shall provide a fixture that meets the complete fixture description.

C. Allowances, when given, cover the cost to the Electrical Contractor, in U.S. dollars, of the lighting fixture only. Allowances do not include lamps, taxes, delivery, handling, installation or Contractor's overhead or profit.

D. Standard fixture catalogue cuts included with this specification section are for general information only, and are not a part of the specification.

E. Custom fixture design drawings and/or modification drawings for standard fixtures provided with the specification are an integral part of the specification and are to be used in conjunction with the fixture descriptions as the full specification for the affected fixture types.

F. Bring any discrepancies between drawing and specifications to the attention of the Architect before submitting bids.

G. Provide “attic stock” of replacement lenses and diffusers for the following fixture types: _____. Quantity shall be equivalent to either 5% of fixture type count or (2), whichever is greater. Attic stock is to be suitably boxed and marked and turned over to the owner as directed.

H. The following fixture types shall not be open to substitution:
_____

I. Fixture Descriptions:

See Appendix 1 for exhibit lighting fixture schedule and cutsheets

PART 3 EXECUTION

3.1 GENERAL

A. Install fixtures complete with lamps, as indicated, and with equipment, materials, parts, attachments, devices, hardware, hangers, cables, supports, channels, frames and brackets necessary to make a safe, complete, and fully operative installation.

B. Verify and provide fixtures that are appropriate for the ceiling and mounting conditions of the project.

C. Reject and do not install blemished damaged or unsatisfactory fixtures. Replace imperfect or unsatisfactory fixtures, if installed, as directed by Architect.

D. Set fixtures, when installed, to be true, and free of light leaks, warps, dents, or other irregularities. No light leaks are permitted at the ceiling line or from any visible part or joint of the fixtures.

E. Provide finish for exposed parts or trims as specified so indicated, provide a finish as directed by Architect.

F. Do not install reflector cones, aperture plates, lenses, diffusers, louvers, and decorative elements of fixtures until completion of wet work, plastering, painting and general clean-up in the area of the fixtures.

G. Mount fixtures at heights and locations indicated on the Contract Drawings, or as required by Architect.

H. In mechanical, electrical, and telephone equipment rooms, lighting fixtures shall be installed on ceilings after piping and equipment therein has been installed. Exact locations for such fixtures shall be determined at the job site during the course of the Work, in coordination with the mechanical and electrical Work.

I. Adequately protect the housing of recessed lighting fixtures during installation by internal blocking or framing to prevent distortion of sides, or dislocation of threaded lugs, which, upon completion, shall be in perfect alignment and match the corresponding holes in frames or rims. Holding screws shall be inserted freely without forcing, and shall remain easily removable for servicing. Threads intended to receive holding installation and removal of knurled headed screws.

J. Upon completion of the installation, the lighting fixtures and lighting equipment shall be in first class operating order and free from defects in condition and finish. At time of final inspection, all fixtures and equipment shall be clean, fully lamped, and be complete with required lenses or diffusers, reflectors, side panels, louvers, or other components necessary for the function of the fixtures. Any reflectors, lenses, diffusers, side panels or other parts damaged prior to the final inspection shall be replaced by Contractor prior to inspection.

3.2 ACCESSIBILITY

A. Install equipment such as junction and pull boxes, fixture housings, transformers, ballasts, switches and controls, and other apparatus that shall be reached from time to time for operation and maintenance, to be easily accessible and appropriate for mounting and ceiling conditions.

3.3 SUPPORTS

A. Provide plaster frames or mounting frames for fixtures that require them. Such frames shall be appropriate for the ceiling construction in which they shall be installed.

B. Provide necessary hardware with fixtures, such as stems, plates, plaster frames, hangers and similar items, for safe support of the fixture. Provide plaster frames made of non-ferrous metal, or of steel that has been suitably rustproofed after fabrication, as described above.

C. Provide supports for fixtures that are adequate to support the weight of the fixtures.

D. Provide visible hanging devices that are finished to match the fixture finish, unless indicated otherwise.

E. Where necessary to meet fire resistance requirements of Building Code authorities, provide enclosures housing recessed fixtures that are constructed to provide required fire resistance rating.

F. Provide attachment devices including brackets, cast metal shapes with the requisite rigidity and strength to maintain continuous alignment of installed fixtures. Attach fixtures to ceiling

supporting members, and do not depend upon lathing, plaster or ceiling tile for alignment or support.

G. Provide fixtures mounted in suspended ceilings that are supported by saddle hangers or the bars attached to runners or between crossbars of ceiling systems. Provide mounting splines or other positive means of maintaining alignment and rigidity.

H. Provide supporting members that are surface passivated, and which are primed or paint-dipped to resist corrosion.

I. Provide fastening devices of a positive locking type, which do not require special tools to apply or remove them. Do not use tie wires in place of fastening devices.

J. Contractor is responsible for the necessary suspension system; Contractor shall ascertain the structural reliability of supports provided under other Sections of the specification.

K. Attach reflectors to housings by means of safety chains, which shall prevent reflectors from falling. No part of the chain may be visible after installation, when viewed from any angle up to 45 degrees from the horizontal.

L. Provide pendant or surface mounted fixtures with required mounting devices and accessories, including hickeys, stud-extensions, ball aligners, canopies, and stems. Uniformly maintain the fixture heights shown on the Contract Drawings or established in the field. The allowable tolerances in individual fixture mounting shall not exceed 1/4 inch and may not vary more than 1/2 inch from the floor mounting height shown on the drawings. Install fixtures hung in continuous runs absolutely level, and in line with each other. Hanging devices shall comply with code requirements.

M. Provide hanging devices which, if visible from normal viewing angles, exactly match fixture finishes.

N. Provide an approved ceiling canopy for each stem, exactly matching fixture finishes.

O. Place stems to be vertical.

P. Provide at least two supports for individually mounted fluorescent fixtures. Where fixtures are ganged, provide supports at 8 ft. intervals, unless otherwise indicated.

3.4 FOCUSING

A. All adjustable lighting fixtures shall be aimed, focused, and locked by the Contractor under supervision of the Lighting Consultant, or Exhibit Designer, or Museum Staff.

B The Contractor is responsible to make provisions as required to have sufficient time allowed, manpower and equipment available for focusing. The Contractor shall ensure focusing to be carried out efficiently without delay and to satisfactory of the Lighting Consultant, Exhibit Designer, and Museum Staff.

C Ladders, tools, and other necessary equipment required for focusing are the responsibility of the Contractor.

D. Focusing of exhibition lighting shall occur after the completion of exhibit installation and the lighting system is confirmed operational. At the time of exhibition lighting focusing, the Contractor shall assure all fixtures, lamps, and accessories (including optical lens and shields) specified are available.

E. Where possible, fixtures shall be focused during normal working hours. However, where daylight interferes, focusing shall be performed during hours after dark.

F. If possible, pre-focus aiming diagram for specific areas and exhibits will be issued by the Lighting Consultant to the Contractor for advance aiming of fixtures. However, adjustment in aiming, lamping and accessories will still be required when reviewed by the Lighting Consultant on site.

3.5 CLEANING

A. Immediately prior to occupancy, clean reflector cones, reflectors, aperture plates, lenses, louvers, lamps and decorative elements. Destaticize lenses after cleaning, installing them to leave no finger or dirt marks.

B. Upon completion of the fixture installation and at the time of final inspection, fixtures shall be clean, and free from marks, dust, spotting or other defects. Replace any broken or defective parts prior to final inspection. Replace or make good all defects revealed by final inspection.

Appendix 1 – Exhibit Lighting Fixture Schedule and Cutsheets

UMNH – EXHIBIT LIGHTING

Light Fixture Schedule – 80% FD Issue

Type	Location	Description	Manufacturer	Lamp	Remarks
C-CF-1	Deleted from XC scope				
C-CF-2	Level 3 Mineral Hall (Inset Case)	Surface mounted single lamp fluorescent striplight	Legion 300 series Bartco Lighting BFL255 series Lightolier SN series	(1) 15W Blacklight UVA T8 lamp	▪ Integral electronic ballast, 120V ▪ Nominal 18” long housing ▪ Standard white finish ▪ Refer to Exhibit Drawings for layout and mounting details ▪ Provide all necessary mounting accessories as required
C-CF-3	Level 3 First People (Table Case) Level 3 Land (Table Case)	Surface mounted single lamp compact fluorescent module	Belfer Lighting 2880 NX2 series Celestial Lighting Channelite series Starfire Lighting	(1) 18W Quad-tube CFL, 3000K, 80+ CRI	▪ Integral electronic ballast, 120V ▪ Standard white finish ▪ Refer to Exhibit Drawings for layout and mounting details ▪ Provide all necessary mounting accessories as required
C-CF-4	Level 2 Our Backyard (Live Display Case)	Surface mounted single lamp fluorescent striplight	TBD	TBD	▪ Exact fixture and lamp specifications to be confirmed by Live Display Consultant

UMNH – EXHIBIT LIGHTING

Light Fixture Schedule – 80% FD Issue

Type	Location	Description	Manufacturer	Lamp	Remarks
C-LE-1	Typical Inset Case	Surface mounted linear high output LED channel	IO Lighting Line 0.75 Series-high output LEDs Winona Lighting V-Line series Electrix Illumination L series SGF Associates	Proprietary white LED Color Temperature: 3000K and 5000K Power consumption: 7.6W per ft Lumen output: For 3000K LEDs - 170 lumen per watt For 5000K LEDs - 230 lumen per watt	▪ Remote power supply (100W max.), 277V/24V ▪ Nominall 3/4" x 3/4" profile x lengths as required ▪ Extruded aluminum housing with standard finish ▪ 60 degree beam distribution ▪ Refer to Exhibit Drawings for layout and mounting details ▪ Provide all necessary mounting accessories as required ▪ Coordinate remote power supply location with Exhibit Designer and field conditions and verify requirement with manufacturer ▪ Submit the following for approval: o drawings showing complete layout and mounting details in all cases o sample of typical mounting and feed components o sample of working fixture

UMNH – EXHIBIT LIGHTING

Light Fixture Schedule – 80% FD Issue

Type	Location	Description	Manufacturer	Lamp	Remarks
C-LE-2	Level 3 Mineral Hall (Wall Case)	Surface mounted linear high output LED channel	IO Lighting Line 0.75 Series-high output LEDs Winona Lighting V-Line series Electrix Illumination L series SGF Associates	Proprietary white LED Color Temperature: 3000K and 5000K Power consumption: 7.6W per ft Lumen output: For 3000K LEDs - 170 lumen per watt For 5000K LEDs - 230 lumen per watt	▪ Remote power supply (100W max.), 277V/24V ▪ Nominall 3/4" x 3/4" profile x lengths as required ▪ Extruded aluminum housing with standard finish ▪ 10 degree beam distribution ▪ Refer to Exhibit Drawings for layout and mounting details ▪ Provide all necessary mounting accessories as required ▪ Coordinate remote power supply location with Exhibit Designer and field conditions and verify requirement with manufacturer ▪ Submit the following for approval: o drawings showing complete layout and mounting details in all cases o sample of typical mounting and feed components o sample of working fixture

UMNH – EXHIBIT LIGHTING

Light Fixture Schedule – 80% FD Issue

Type	Location	Description	Manufacturer	Lamp	Remarks
C-LE-3	Inset Case	Surface mounted linear standard output LED channel	IO Lighting Line 0.75 Series-standard output LEDs Winona Lighting V-Line series Electrix Illumination L series SGF Associates	Proprietary white LED Color Temperature: 3000K and 5000K Power consumption: 2.1W per ft Lumen output: For 3000K LEDs - 34 lumen per watt For 5000K LEDs - 40 lumen per watt	▪ Remote power supply (100W max.), 277V/24V ▪ Nominall 3/4" x 3/4" profile x lengths as required ▪ Extruded aluminum housing with standard finish ▪ 60 degree beam distribution ▪ Refer to Exhibit Drawings for layout and mounting details ▪ Provide all necessary mounting accessories as required ▪ Coordinate remote power supply location with Exhibit Designer and field conditions and verify requirement with manufacturer ▪ Submit the following for approval: o drawings showing complete layout and mounting details in all cases o sample of typical mounting and feed components o sample of working fixture
C-LE-4	Deleted from project				
C-LE-5	Deleted from project				
C-LE-6	Deleted from project				
C-LE-8	Deleted from project				

UMNH – EXHIBIT LIGHTING

Light Fixture Schedule – 80% FD Issue

Type	Location	Description	Manufacturer	Lamp	Remarks
C-LV	Exhibit Case	Integrated in casework single-circuit low voltage track system with LED track fixtures	Bruck Lighting VA Track Series + Ledra Series LED track fixtures	Proprietary 1W/3W LED, 3000K warm white, 80+ CRI	▪ Remote magnetic transformers, 277V/12V ▪ Integral dimmer with dimming range from 100% to 15% ▪ Finish of track and all components as per Architect ▪ Track shall be rigid extruded cooper and not bendable in field ▪ Refer to Exhibit Drawings for track layouts and mounting details ▪ Track system shall include tracks, mounting brackets/supports, and power feed/connectors for all runs and mounting configurations as shown in Exhibit Drawings for a complete operable low voltage track system ▪ Provide fixtures with 1W and 3W LED (exact quantity TBD) ▪ Provide (5) types of exchangeable front lens assembly with various beam distribution (exact beam angle and quantity TBD) ▪ Provide removable snoot shield (exact quantity TBD) ▪ Submit the following for approval: o drawings showing complete layout and mounting details in all cases o sample of typical mounting and feed components o sample of all fixtures, lens assemblies, snoot shield ▪ Focusing required after installation is completed

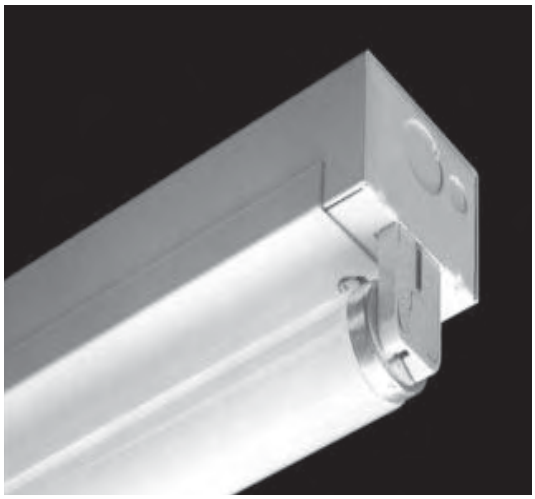
UMNH – EXHIBIT LIGHTING

Light Fixture Schedule – 80% FD Issue

Type	Location	Description	Manufacturer	Lamp	Remarks
C-TQ-1	Deleted from XC scope				
C-TQ-2	Deleted from XC scope				
C-TQ-3	Deleted from XC scope				
C-YS-1	Deleted from XC scope				

APPLICATIONS

Specifiers choice for a variety of display and utility lighting needs. Compact design occupies minimum space. Quality components, welded construction assuring long trouble free life. Broad range of types and lengths to provide the right light for the job.



SPECIFICATIONS

CONSTRUCTION: Die formed of 20 gauge cold rolled prime steel, rigidly fabricated, and electrically welded to insure true and perfect alignment.

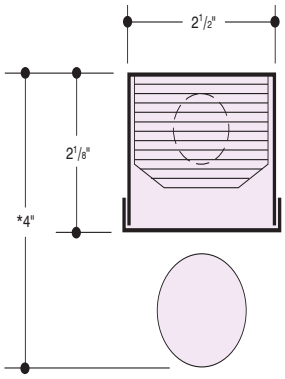
MOUNTING: Installed flush with ceiling surface or stem mounted, singly or in continuous rows. For continuous mounting, end knockouts may be removed and units joined together. Adequate knockouts and holes are provided for mounting and feeds.

ELECTRICAL: Thermally protected Class "P" Energy Saving 265MA-T8 electronic ballasts, 430MA Rapid Start HPF, Trigger Start LPF-T12 magnetic ballasts for 118 volt 60 Hz operation standard. Other electronic ballasts, other voltages and frequencies available, consult factory. (see Options listing).

FINISH: All steel component parts are completely protected against rust and discoloration after fabrication through an automated conveyorized multi-stage phosphate bonding process. Finished with an electrostatic baked white polyester thermosetting powder coating. This electronic computer controlled integrated system assures consistent 88%+ reflectance efficiency and maximum durability.

CERTIFICATION: The Series 300 is U.L. and C.U.L. listed and bears the label of the I.B.E.W./AFL-CIO, Local #3.

Due to the very nature of coves and enclosed areas, the heat ambiance temperature must be considered when designing and installing in confined spaces, so that the spaces are adequately ventilated to provide heat dissipation and air circulation to prevent ballast cycling, failure, or reduced ballast and lamp life.



Dimensions shown are with T-12 lamp.
* Minus 1/4" for OCTRON T-8 lamp.

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LEGION® LIGHTING CO., INC.
221 Glenmore Ave., Brooklyn, NY 11207 • Tel: 718/498-1770 • Fax: 718/498-0128
Toll Free Fax: 800/4-LEGION

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ORDERING DATA

Catalog No.	No. and Type Lamps	Nominal Dimensions	Weight
300-114	1-14W-TS-T12	2 1/2" x 15"	3
300-115	1-15W-TS-T12	2 1/2" x 18"	3
300-120	1-20W-TS-T12	2 1/2" x 24"	4
300-117 EBO	1-FO17-OCT-T8	2 1/2" x 24"	4
300-130	1-30W-RS-T12	2 1/2" x 36"	7
300-125 EBO	1-FO25-OCT-T8	2 1/2" x 36"	7
300-140	1-40W-RS-T12	2 1/2" x 48"	8
300-132 EBO	1-FO32-OCT-T8	2 1/2" x 48"	8
300-160 EBO	1-FO40-OCT-T8	2 1/2" x 60"	11
300-130-6T	2-30W-RS-T12	2 1/2" x 72"	14
300-125-6T EBO	2-FO25-OCT-T8	2 1/2" x 72"	14
300-140-8T	2-40W-RS-T12	2 1/2" x 96"	16
300-132-8T EBO	2-FO32-OCT-T8	2 1/2" x 96"	16

OPTIONS

Suffix "DIM" after catalog no. for dimming ballast.
Suffix "LT" after catalog no. for cold weather ballast.
Suffix "DL" after catalog no. for damp location.
Suffix "EM" after catalog no. for emergency battery pack, and see price list for types.
Suffix "XTA" after catalog no. for XTRALUME® reflector standard with 85% reflectance, for 95% reflectance please specify your requirements.
Suffix "SYM" after catalog no. for post powder coated white SYMMETRIC reflector.
Suffix "ASYM" after catalog no. for post powder coated white ASYMMETRIC reflector.
Suffix "ASYM1" after catalog no. for post powder coated white ASYMMETRIC reflector.
• Suffix "WG" after catalog no. for wire guard.

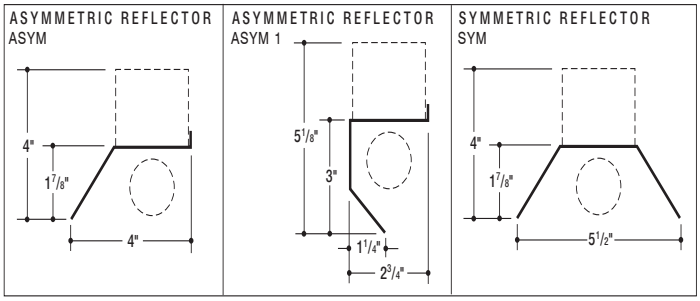
• Consult factory for availability of "WG" wire guard and minimum quantity order. Reflector available in perforated metal, add Suffix "PERF" to catalog no. i.e.: ASYM-PERF.

ENERGY SAVING BALLASTS: Where applicable (consult factory). Suffix "ESB" after catalog number, then / and one of the following:

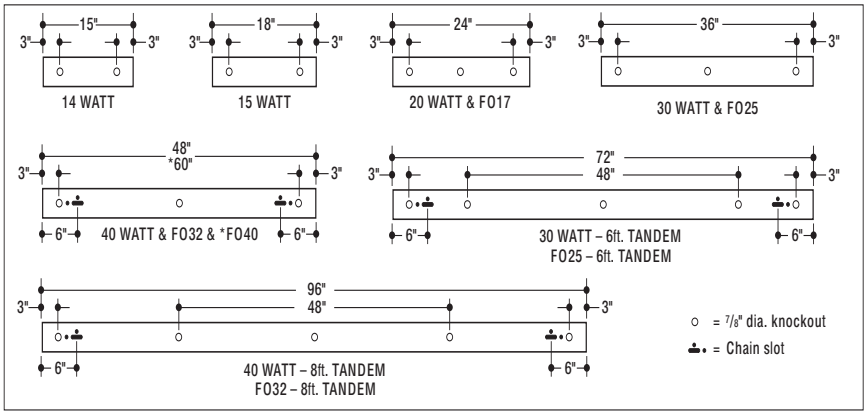
MAGNETIC
"SLH"- Super Low Heat T12 Ballast
"MM-I"- Maxi Miser I T12 Ballast
"PRE"- Premium III T12 Ballast
"OCT"- Octron T8 Ballast
"OPT"- Optimiser Ballast
"DIM"- Magnetic T12 Dimming Ballast

ELECTRONIC
"EB"- Electronic T12 Ballast
"EBO"- Electronic T8 Octron Ballast
"EBD"- Electronic T12 Dimming Ballast
"EBDO"- Electr. T8 Octron Dimming Ballast

REFLECTOR OPTIONS



BACK PLANS



For Photometric Data consult factory.
Information supplied primarily for illustrative purposes, subject to change.
Consult factory for verification and minimum quantity orders.

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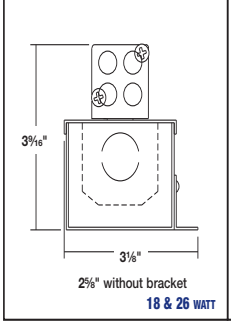
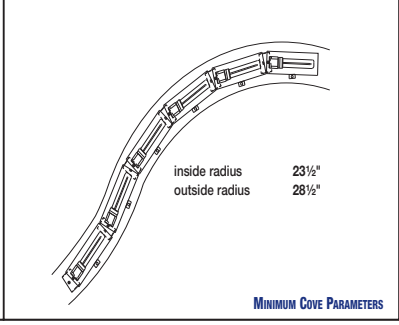
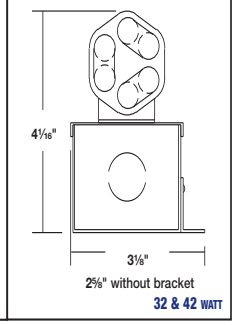






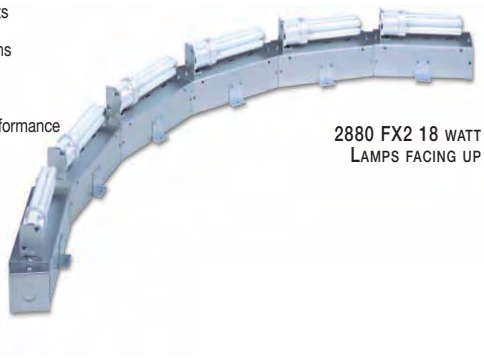
2880 NX2™ & FX2™

QUAD AND TRIPLE TUBE SEAMLESS STRAIGHT AND FIELD CURVABLE SYSTEM

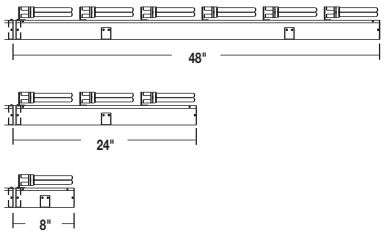
- Lamp Compatible with Specification Grade Downlights
- Linkable Seamless Straight and Field Curvable Lengths
- Constructed of Formed Satin Anodized Aluminum
- 18 or 26 watt Quad and 32 or 42 watt Triple High Performance Compact Fluorescent Lamps *(refer to page 8-33)*
- Voltage Options:
  - 120 volt
  - 277 volt
- Ballasts Options *(refer to page III)*
  - Electronic
  - Dimming*

  ** Dimming applications require an alternate configuration. Please consult factory.*

  Emergency Ballasts are available. Please consult factory.
- 8" On Center Spacing
- Lengths Through Wired for Easy Installation
- Exterior Mounting Clips for Quick, Easy Anchoring
- Custom Reflectors can be manufactured to your specifications. *(refer to page 8-34)*
- UL and CUL Listed Damp Location



2880 FX2 18 WATT
LAMPS FACING UP



Ordering Format for 2880 NX2 & FX2

Choose one from each category

SERIES	LAMP CONFIGURATION	LAMP	VOLTAGE	BALLAST	LENGTH
2880 linear fixture	**NX2** seamless straight lamp up or down	**18 watt Quad** *(G24q-2)*	**1** 120 volt	**E** electronic	**48** 48" length *(6 lamps)*
	FX2 field curvable lamp up or down	**26 watt Quad** (G24q-3)	**2** 277 volt	**D** dimming* (18, 26 & 32 watt only)	**24** 24" length *(3 lamps)*
		32 watt Triple (G24q-3)			**8** 8" length *(1 lamp)*
		42 watt Triple (G24q-4)			

c UL US LISTED
DAMP LOCATION

NOTE:
* Dimming applications require an alternate configuration. Please consult factory.

These products protected by one or more of the following U.S. Patent Numbers 5,448,460, 5,221,139 & 5,452,187. Other patents pending. Modifications and custom configurations are available. Please contact our Sales Department.

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line™ .75

SYMMETRIC

io

Application

io Lighting's **line series .75** is approximately .75" x .75" in cross section. UL Listed for damp locations, its low profile housing enables functional luminous intensities from "tight" architectural details such as niches, coves & casework. Similar to halogen light sources, LEDs are point sources that offer superior definition to three dimensional objects and sparkle to reflective surfaces.

series .75 is a low voltage linear accent luminaire that may be ordered in incremental nominal lengths that range from 6" to 96". Optional beam spreads along the perpendicular axis of the fixture include 10°, 45°, and 65°. For details on the asymmetric beam spread, see dedicated specification sheet. **io** ensures that each LED is driven with the proper current and voltage which enables the average rated life to be 50,000 hours at 70% of the lamp lumen output. To ensure proper performance, architectural details should allow for ventilation and air flow around the fixture. Ambient temperature surrounding the fixture shall not exceed 120˚F.

Light Output

line series .75 is available with two lumen outputs for white light only. Red, green and blue are available in high output only. IES format files may be obtained from the factory or downloaded from **www.iolighting.com.**

Standard Output	High Output
3000K White: 34 lms/ft	3000K White: 170 lms/ft
5000K White: 40 lms/ft	5000K White: 230 lms/ft

Construction

The light weight, yet durable, extruded aluminum housing provides recommended heat sink requirements for LEDs. Patented optical assembly is composed of a customized acrylic material that offers very high transmisivity, UV stability, and excellent longevity. **series .75** is UL Listed for damp locations only.

Electrical

4'-0" 22 AWG, 600 volt TFFN rated power cords are supplied with strain reliefs. 24 volt 100 watt power supply will be provided as a standard. See daisy chain and remote distance requirements in chart on the lower left hand corner of this specification sheet. Alternate power supply options are available. Consult **io** website or **io** representative for **io** driver specification sheets.

Power supply and dimming module must be specified separately. For detailed information, see the **LED Linear** brochure or download the Power Supply specification sheet from **www.iolighting.com**.

Power Consumption

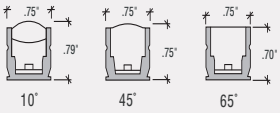
Standard Output: 2.1 w/ft **High Output: 7.6 w/ft**

Power consumption does not include power supply losses. Consult **io** driver specification sheets for losses associated with each driver option.

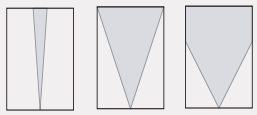
Finish

Anodized aluminum finish is standard. Custom finishes may be available upon request.

Dimensions



Beam Spreads



Power Supply

Standard Output

TYPE	SUPPLIES	REMOTE DISTANCE
24v100w	up to 35'-0"	7'-0" (w/22AWG)
	(2) RUNS UP TO	18'-0" (w/18AWG)
	49' WITH (1) RUN	46'-0" (w/14AWG)
	NTE 35'-0"	71'-0" (w/12AWG)

High Output

TYPE	SUPPLIES	REMOTE DISTANCE
24v100w	up to 12'-0"	7'-0" (w/22AWG)
		18'-0" (w/18AWG)
		46'-0" (w/14AWG)
		71'-0" (w/12AWG)

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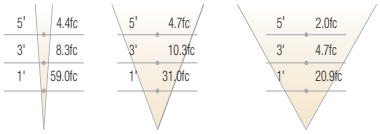
io line™ .75
SYMMETRIC

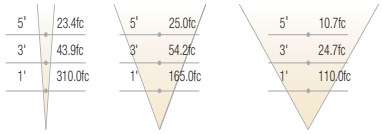
Light Output / Distributions / Electrical Feed Options

STANDARD OUTPUT



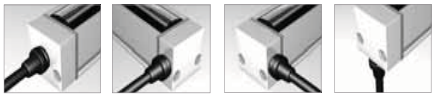
10°	45°	65°
3000K	3000K	3000K
8'-0"	8'-0"	8'-0"

HIGH OUTPUT



10°	45°	65°
3000K	3000K	3000K
8'-0"	8'-0"	8'-0"

ELECTRICAL END FEED OPTIONS



2 End feed | 3 Right side feed | 4 Left side feed | 5 Bottom feed

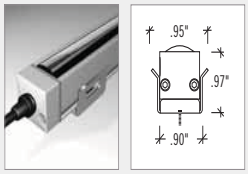
LIGHT OUTPUT CONVERSION TABLE

White Light Output	3000K S.O.	5000K S.O.	3000K H.O.	5000K H.O.
Light Output Multiplier	0.2(2)	0.24(2)	1.0(2)	1.35(2)

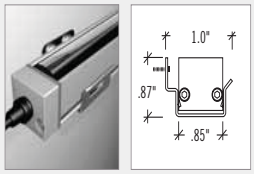
Color Light Output	RED	GREEN	BLUE
Light Output Multiplier	0.47(1)	0.71 (1)	0.24 (1)

IES format photometrics may be downloaded from **www.iolighting.com**

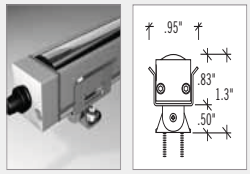
Mounting Options



100 Surface (**io** part #: SA.BK.SURF)



101 Side surface (**io** part #: SA.BK.WALL)



102 Field adjustable (**io** part #: SA.BK.ADJUST)

Order Code

io	.	1	.	2	.	3	.	4	.	5	.	6	.	7	.	8	.	9	.	10
0	.	03	.		.		.		.		.		.		.		.		.	

1. LINE SERIES
03 .75 S.O. or H.O.

2. LOCATION
I Interior
E Exterior (Note: Rated for damp locations face down only)

3. COLOR
3K White 3000K (Standard)(2)
3KHO White 3000K (High Output)(2)
5K White 5000K (Standard)(2)
5KHO White 5000K (High Output)(2)
R Red(1)
G Green(1)
B Blue(1)

4. DISTRIBUTION
10 10 degree
45 45 degree
65 65 degree

5. MOUNTING
100 Surface
101 Side surface
102 Field adjustable

6. FINISH
1 Anodized Aluminum
2 Anodized Custom Color

7. LENGTH

	UNITS	(ACTUAL)
01	6"	(6.26")(3)
02	12"	(11.95")(3)
03	18"	(17.7")(3)
04	24"	(23.26")(3)
05	30"	(28.95")(3)
06	36"	(34.7")(3)
07	42"	(40.26")(3)
08	48"	(45.95")(3)
09	54"	(51.7")(3)
10	60"	(57.26")(3)
11	66"	(62.95")(3)
12	72"	(68.7")(3)
13	78"	(79.95")(3)
14	84"	(85.7")(3)
15	90"	(91.26")(3)
16	96"	(96.95")(3)

8. ELECTRICAL FEED
2 End feed
3 Right side feed
4 Left side feed
5 Bottom feed
FOR CONTINUOUS ROW
2-2 Right end feed
Left end feed
3-4 Right side feed
Left side feed
5-5 Right bottom feed
Left bottom feed

9. VOLTAGE / DIMMING
1 120v
2 277v
3 120v w/dim
4 277v w/dim
5 Other

10. SPECIFY DRIVER / DIMMING
Note: Reference **io** power supply specification sheet for driver and dimming options. If left blank, **io** will supply 100 watt drivers. Download Power Supply specification sheet from **www.iolighting.com**

Footnotes

Footnotes
1. Refer to conversion table for output.
2. White light variance between LED's within a single fixture will not exceed +/- 200k.
3. "Actual" length provided includes end feed and non-feed endcaps. Add .27 to each length when electrical feeds occur on both endcaps (for continuous row mounting).

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ADVANCE

XITANIUM
LED Drivers

Universal Outdoor Drivers for 12V and 24V LED systems

Applications

Orientation/Step Lighting

Architectural Lighting

Channel Letters

Contour Lighting

Edge Lighting

LEDs have evolved into a practical, flexible light source for a wide variety of illumination applications. Common LED products available in the market today are configured in a series-parallel array – designed to be powered by a suitable 24vdc driver – which allows flexibility to connect variable load levels. These operating voltages have become the standard in the industry.

The Brain Behind the Bright Idea

Xitanium LED drivers from Advance are designed specifically for 24V LED systems and incorporate features that enable broad commercialization of end-use solid-state lighting products.

Features	Benefits
UL Class 2	Limited output voltage and current plus isolation for safe operation
UL Outdoor Damp location rated - IP 66	Fully potted for moisture resistance and thermal benefits
Ultra small, compact size	Facilitates new, low-profile fixture design
Extreme low temperature Performance (-40°C)	Allows use in any outdoor application
Generous high temperature capability (+60°C)	Margin flexibility to facilitate fixture design
Tightly regulated output (1% line, 5% load)	Consistent light output across line and load levels
5 year warranty	Peace of mind for your new products and for end users…from the industry's most trusted component maker
Powered by Advance	Advance is preferred by end users – Enhance the value of your product

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Quick Selection Table

Catalog Number	Description	Application
LEDINTA0024V41FO	Intellivolt 100 Watt 24Vdc Outdoor	• 24Vdc LED Systems

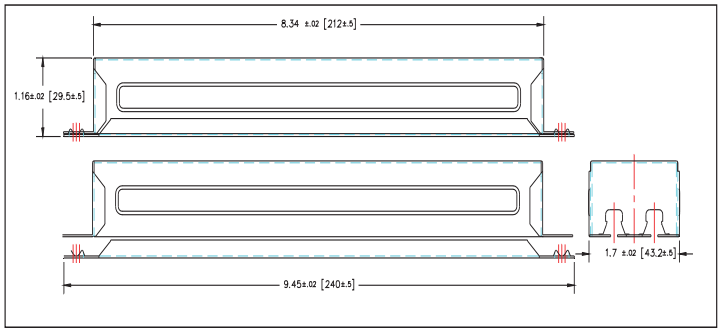
LED Driver Specifications

Description	Catalog Number	Input			Output			Case Temp Max (°C)	Figure	Weight (Grams)
		Volts (V)	Power Max (W)	Current Max (A)	Power Max (W)	Voltage Nom (V)	Current Max (A)			
100 Watt	LEDINTA0024V41FO	120	117.0	0.98	100.0	24.0	4.1	90	A	640
		230		0.51						
		277		.042						

Total Harmonic Distortion: 20% max
Power Factor: 90% min
Line Regulation: 1% output variation across input voltage range
Load Regulation: 5% output variation across input voltage range
Current Crest Factor: 1.5 max
Environmental Protection: IP66 outdoor rated
EMI: FCC47 SubPart15, CISPR15 and CISPR22 Class A
Protection: Meet UL1310 for Class 2; Inherent short-circuit protection, self-limited; overload protected; 3.2KV output insulation
AC Input and DC Output: 2 (0.78mm²) Solid Copper Wires, 15cm long

Dimensions

Fig. A

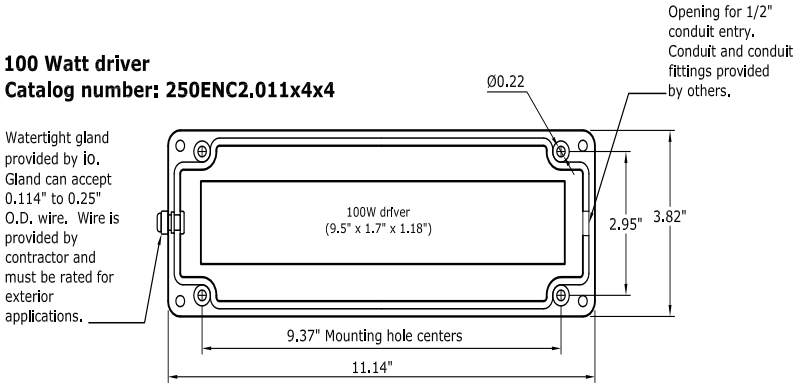


Advance, A Division of Philips Electronics North America · 10275 W Higgins Road · Rosemont, IL 60018 · USA
Tel: + 1 847 390-5205 · Fax: + 1 847 390-5264 · Revised 09/05PJJ

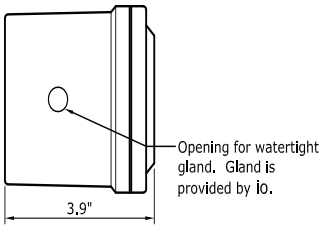
line

100W driver enclosure

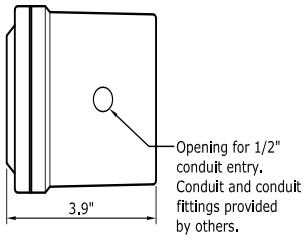
100 Watt driver
Catalog number: 250ENC2.011x4x4



Front view without cover



Left end view with cover



Right end view with cover

Enclosure Construction

Enclosure material is a molded fiberglass reinforced polyester (thermoset). The gasket is poured polyurethane seamless gasket that provides watertight, dust-tight environmental seal. The cover screws are recessed, captive and stainless steel.

Enclosure Industry Standards

UL/cUL 50	File E64358 type 1, 3, 4X, 6P, 12
NEMA 250	Type 1, 3, 4X, 6P, 12
CSA Std 22.2	File LR069014 type 1, 3, 4X, 6P, 12
Temp rating	(-40°C to +120°C)
Flammability rating	UL94-5V

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line™ .75

SYMMETRIC

io

Application

io Lighting's **line series .75** is approximately .75" x .75" in cross section. UL Listed for damp locations, its low profile housing enables functional luminous intensities from "tight" architectural details such as niches, coves & casework. Similar to halogen light sources, LEDs are point sources that offer superior definition to three dimensional objects and sparkle to reflective surfaces.

series .75 is a low voltage linear accent luminaire that may be ordered in incremental nominal lengths that range from 6" to 96". Optional beam spreads along the perpendicular axis of the fixture include 10°, 45°, and 65°. For details on the asymmetric beam spread, see dedicated specification sheet. **io** ensures that each LED is driven with the proper current and voltage which enables the average rated life to be 50,000 hours at 70% of the lamp lumen output. To ensure proper performance, architectural details should allow for ventilation and air flow around the fixture. Ambient temperature surrounding the fixture shall not exceed 120˚F.

Light Output

line series .75 is available with two lumen outputs for white light only. Red, green and blue are available in high output only. IES format files may be obtained from the factory or downloaded from **www.iolighting.com.**

Standard Output	High Output
3000K White: 34 lms/ft	3000K White: 170 lms/ft
5000K White: 40 lms/ft	5000K White: 230 lms/ft

Construction

The light weight, yet durable, extruded aluminum housing provides recommended heat sink requirements for LEDs. Patented optical assembly is composed of a customized acrylic material that offers very high transmisivity, UV stability, and excellent longevity. **series .75** is UL Listed for damp locations only.

Electrical

4'-0" 22 AWG, 600 volt TFFN rated power cords are supplied with strain reliefs. 24 volt 100 watt power supply will be provided as a standard. See daisy chain and remote distance requirements in chart on the lower left hand corner of this specification sheet. Alternate power supply options are available. Consult **io** website or **io** representative for **io** driver specification sheets.

Power supply and dimming module must be specified separately. For detailed information, see the **LED Linear** brochure or download the Power Supply specification sheet from **www.iolighting.com**.

Power Consumption

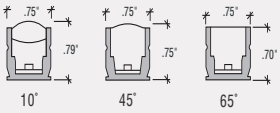
Standard Output: 2.1 w/ft **High Output: 7.6 w/ft**

Power consumption does not include power supply losses. Consult **io** driver specification sheets for losses associated with each driver option.

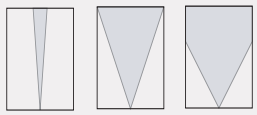
Finish

Anodized aluminum finish is standard. Custom finishes may be available upon request.

Dimensions



Beam Spreads



Power Supply

Standard Output

TYPE	SUPPLIES	REMOTE DISTANCE
24v100w	up to 35'-0"	7'-0" (w/22AWG)
	(2) RUNS UP TO	18'-0" (w/18AWG)
	49' WITH (1) RUN	46'-0" (w/14AWG)
	NTE 35'-0"	71'-0" (w/12AWG)

High Output

TYPE	SUPPLIES	REMOTE DISTANCE
24v100w	up to 12'-0"	7'-0" (w/22AWG)
		18'-0" (w/18AWG)
		46'-0" (w/14AWG)
		71'-0" (w/12AWG)

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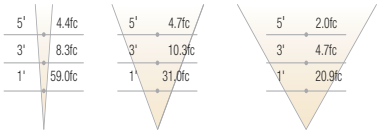
io line™ .75
SYMMETRIC

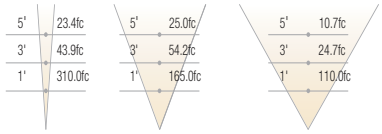
Light Output / Distributions / Electrical Feed Options

STANDARD OUTPUT



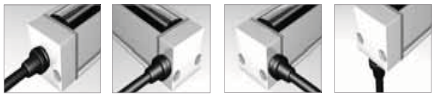
10°	45°	65°
3000K	3000K	3000K
8'-0"	8'-0"	8'-0"

HIGH OUTPUT



10°	45°	65°
3000K	3000K	3000K
8'-0"	8'-0"	8'-0"

ELECTRICAL END FEED OPTIONS



2 End feed | 3 Right side feed | 4 Left side feed | 5 Bottom feed

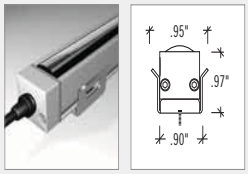
LIGHT OUTPUT CONVERSION TABLE

White Light Output	3000K S.O.	5000K S.O.	3000K H.O.	5000K H.O.
Light Output Multiplier	0.2(2)	0.24(2)	1.0(2)	1.35(2)

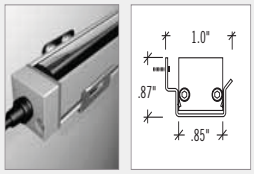
Color Light Output	RED	GREEN	BLUE
Light Output Multiplier	0.47(1)	0.71 (1)	0.24 (1)

IES format photometrics may be downloaded from **www.iolighting.com**

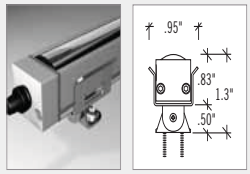
Mounting Options



100 Surface (**io** part #: SA.BK.SURF)



101 Side surface (**io** part #: SA.BK.WALL)



102 Field adjustable (**io** part #: SA.BK.ADJUST)

Order Code

io	1	2	3	4	5	6	7	8	9	10
0 .	03 .		.	.	.	.	.	.	.	.

1. LINE SERIES
03 .75 S.O. or H.O.

2. LOCATION
I Interior
E Exterior (Note: Rated for damp locations face down only)

3. COLOR
3K White 3000K (Standard)(2)
3KHO White 3000K (High Output)(2)
5K White 5000K (Standard)(2)
5KHO White 5000K (High Output)(2)
R Red(1)
G Green(1)
B Blue(1)

4. DISTRIBUTION
10 10 degree
45 45 degree
65 65 degree

5. MOUNTING
100 Surface
101 Side surface
102 Field adjustable

6. FINISH
1 Anodized Aluminum
2 Anodized Custom Color

7. LENGTH

	UNITS	(ACTUAL)
01	6"	(6.26")(3)
02	12"	(11.95")(3)
03	18"	(17.7")(3)
04	24"	(23.26")(3)
05	30"	(28.95")(3)
06	36"	(34.7")(3)
07	42"	(40.26")(3)
08	48"	(45.95")(3)
09	54"	(51.7")(3)
10	60"	(57.26")(3)
11	66"	(62.95")(3)
12	72"	(68.7")(3)
13	78"	(79.95")(3)
14	84"	(85.7")(3)
15	90"	(91.26")(3)
16	96"	(96.95")(3)

8. ELECTRICAL FEED
2 End feed
3 Right side feed
4 Left side feed
5 Bottom feed
FOR CONTINUOUS ROW
2-2 Right end feed
Left end feed
3-4 Right side feed
Left side feed
5-5 Right bottom feed
Left bottom feed

9. VOLTAGE / DIMMING
1 120v
2 277v
3 120v w/dim
4 277v w/dim
5 Other

10. SPECIFY DRIVER / DIMMING
Note: Reference **io** power supply specification sheet for driver and dimming options. If left blank, **io** will supply 100 watt drivers. Download Power Supply specification sheet from **www.iolighting.com**

Footnotes

Footnotes
1. Refer to conversion table for output.
2. White light variance between LED's within a single fixture will not exceed +/- 200k.
3. "Actual" length provided includes end feed and non-feed endcaps. Add .27 to each length when electrical feeds occur on both endcaps (for continuous row mounting).

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ADVANCE

XITANIUM
LED Drivers

Universal Outdoor Drivers for 12V and 24V LED systems

Applications

Orientation/Step Lighting

Architectural Lighting

Channel Letters

Contour Lighting

Edge Lighting

LEDs have evolved into a practical, flexible light source for a wide variety of illumination applications. Common LED products available in the market today are configured in a series-parallel array – designed to be powered by a suitable 24vdc driver – which allows flexibility to connect variable load levels. These operating voltages have become the standard in the industry.

The Brain Behind the Bright Idea

Xitanium LED drivers from Advance are designed specifically for 24V LED systems and incorporate features that enable broad commercialization of end-use solid-state lighting products.

Features	Benefits
UL Class 2	Limited output voltage and current plus isolation for safe operation
UL Outdoor Damp location rated - IP 66	Fully potted for moisture resistance and thermal benefits
Ultra small, compact size	Facilitates new, low-profile fixture design
Extreme low temperature Performance (-40°C)	Allows use in any outdoor application
Generous high temperature capability (+60°C)	Margin flexibility to facilitate fixture design
Tightly regulated output (1% line, 5% load)	Consistent light output across line and load levels
5 year warranty	Peace of mind for your new products and for end users…from the industry's most trusted component maker
Powered by Advance	Advance is preferred by end users – Enhance the value of your product

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Quick Selection Table

Catalog Number	Description	Application
LEDINTA0024V41FO	Intellivolt 100 Watt 24Vdc Outdoor	• 24Vdc LED Systems

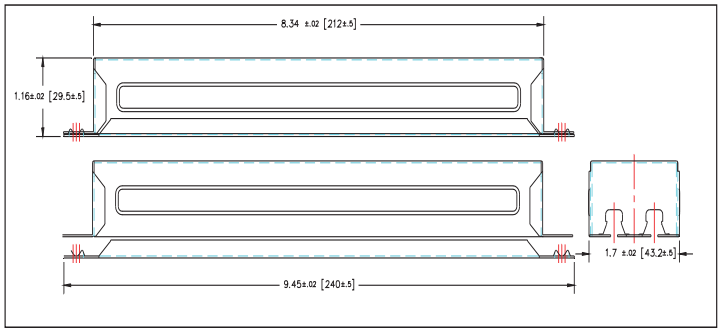
LED Driver Specifications

Description	Catalog Number	Input			Output			Case Temp Max (°C)	Figure	Weight (Grams)
		Volts (V)	Power Max (W)	Current Max (A)	Power Max (W)	Voltage Nom (V)	Current Max (A)			
100 Watt	LEDINTA0024V41FO	120	117.0	0.98	100.0	24.0	4.1	90	A	640
		230		0.51						
		277		.042						

Total Harmonic Distortion: 20% max
Power Factor: 90% min
Line Regulation: 1% output variation across input voltage range
Load Regulation: 5% output variation across input voltage range
Current Crest Factor: 1.5 max
Environmental Protection: IP66 outdoor rated
EMI: FCC47 SubPart15, CISPR15 and CISPR22 Class A
Protection: Meet UL1310 for Class 2; Inherent short-circuit protection, self-limited; overload protected; 3.2KV output insulation
AC Input and DC Output: 2 (0.78mm²) Solid Copper Wires, 15cm long

Dimensions

Fig. A

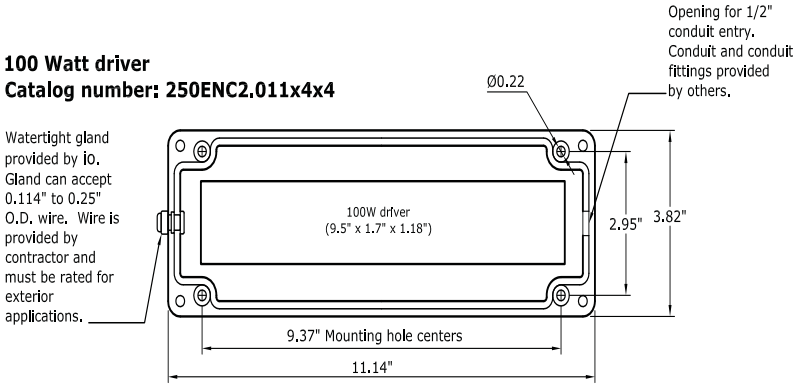


Advance, A Division of Philips Electronics North America · 10275 W Higgins Road · Rosemont, IL 60018 · USA
Tel: + 1 847 390-5205 · Fax: + 1 847 390-5264 · Revised 09/05PJJ

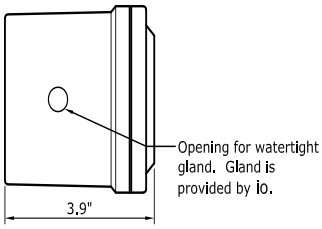
line

100W driver enclosure

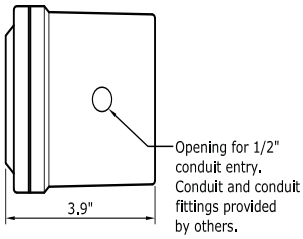
100 Watt driver
Catalog number: 250ENC2.011x4x4



Front view without cover



Left end view with cover



Right end view with cover

Enclosure Construction

Enclosure material is a molded fiberglass reinforced polyester (thermoset). The gasket is poured polyurethane seamless gasket that provides watertight, dust-tight environmental seal. The cover screws are recessed, captive and stainless steel.

Enclosure Industry Standards

UL/cUL 50	File E64358 type 1, 3, 4X, 6P, 12
NEMA 250	Type 1, 3, 4X, 6P, 12
CSA Std 22.2	File LR069014 type 1, 3, 4X, 6P, 12
Temp rating	(-40°C to +120°C)
Flammability rating	UL94-5V

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line™ .75

SYMMETRIC

io

Application

io Lighting's **line series .75** is approximately .75" x .75" in cross section. UL Listed for damp locations, its low profile housing enables functional luminous intensities from "tight" architectural details such as niches, coves & casework. Similar to halogen light sources, LEDs are point sources that offer superior definition to three dimensional objects and sparkle to reflective surfaces.

series .75 is a low voltage linear accent luminaire that may be ordered in incremental nominal lengths that range from 6" to 96". Optional beam spreads along the perpendicular axis of the fixture include 10°, 45°, and 65°. For details on the asymmetric beam spread, see dedicated specification sheet. **io** ensures that each LED is driven with the proper current and voltage which enables the average rated life to be 50,000 hours at 70% of the lamp lumen output. To ensure proper performance, architectural details should allow for ventilation and air flow around the fixture. Ambient temperature surrounding the fixture shall not exceed 120˚F.

Light Output

line series .75 is available with two lumen outputs for white light only. Red, green and blue are available in high output only. IES format files may be obtained from the factory or downloaded from **www.iolighting.com.**

Standard Output	High Output
3000K White: 34 lms/ft	3000K White: 170 lms/ft
5000K White: 40 lms/ft	5000K White: 230 lms/ft

Construction

The light weight, yet durable, extruded aluminum housing provides recommended heat sink requirements for LEDs. Patented optical assembly is composed of a customized acrylic material that offers very high transmisivity, UV stability, and excellent longevity. **series .75** is UL Listed for damp locations only.

Electrical

4'-0" 22 AWG, 600 volt TFFN rated power cords are supplied with strain reliefs. 24 volt 100 watt power supply will be provided as a standard. See daisy chain and remote distance requirements in chart on the lower left hand corner of this specification sheet. Alternate power supply options are available. Consult **io** website or **io** representative for **io** driver specification sheets.

Power supply and dimming module must be specified separately. For detailed information, see the **LED Linear** brochure or download the Power Supply specification sheet from **www.iolighting.com**.

Power Consumption

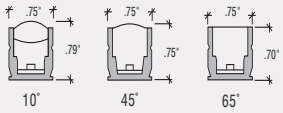
Standard Output: 2.1 w/ft **High Output: 7.6 w/ft**

Power consumption does not include power supply losses. Consult **io** driver specification sheets for losses associated with each driver option.

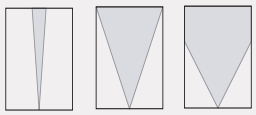
Finish

Anodized aluminum finish is standard. Custom finishes may be available upon request.

Dimensions



Beam Spreads



Power Supply

Standard Output

TYPE	SUPPLIES	REMOTE DISTANCE
24v100w	up to 35'-0"	7'-0" (w/22AWG)
	(2) RUNS UP TO	18'-0" (w/18AWG)
	49' WITH (1) RUN	46'-0" (w/14AWG)
	NTE 35'-0"	71'-0" (w/12AWG)

High Output

TYPE	SUPPLIES	REMOTE DISTANCE
24v100w	up to 12'-0"	7'-0" (w/22AWG)
		18'-0" (w/18AWG)
		46'-0" (w/14AWG)
		71'-0" (w/12AWG)

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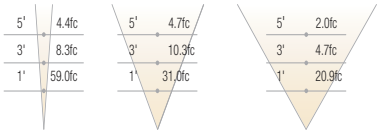
io line™ .75
SYMMETRIC

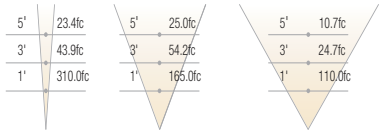
Light Output / Distributions / Electrical Feed Options

STANDARD OUTPUT



10°	45°	65°
3000K	3000K	3000K
8'-0"	8'-0"	8'-0"

HIGH OUTPUT



10°	45°	65°
3000K	3000K	3000K
8'-0"	8'-0"	8'-0"

ELECTRICAL END FEED OPTIONS

2 End feed

3 Right side feed

4 Left side feed

5 Bottom feed

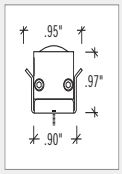
LIGHT OUTPUT CONVERSION TABLE

White Light Output	3000K S.O.	5000K S.O.	3000K H.O.	5000K H.O.
Light Output Multiplier	0.2(2)	0.24(2)	1.0(2)	1.35(2)

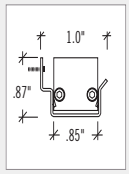
Color Light Output	RED	GREEN	BLUE
Light Output Multiplier	0.47(1)	0.71 (1)	0.24 (1)

IES format photometrics may be downloaded from **www.iolighting.com**

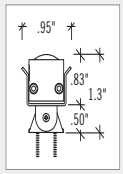
Mounting Options



100 Surface (**io** part #: SA.BK.SURF)



101 Side surface (**io** part #: SA.BK.WALL)



102 Field adjustable (**io** part #: SA.BK.ADJUST)

Order Code

io	.	1	.	2	.	3	.	4	.	5	.	6	.	7	.	8	.	9	.	10
0	.	03	.		.		.		.		.		.		.		.		.	

1. LINE SERIES
03 .75 S.O. or H.O.

2. LOCATION
I Interior
E Exterior (Note: Rated for damp locations face down only)

3. COLOR
3K White 3000K (Standard)(2)
3KHO White 3000K (High Output)(2)
5K White 5000K (Standard)(2)
5KHO White 5000K (High Output)(2)
R Red(1)
G Green(1)
B Blue(1)

4. DISTRIBUTION
10 10 degree
45 45 degree
65 65 degree

5. MOUNTING
100 Surface
101 Side surface
102 Field adjustable

6. FINISH
1 Anodized Aluminum
2 Anodized Custom Color

7. LENGTH

	UNITS	(ACTUAL)
01	6"	(6.26")(3)
02	12"	(11.95")(3)
03	18"	(17.7")(3)
04	24"	(23.26")(3)
05	30"	(28.95")(3)
06	36"	(34.7")(3)
07	42"	(40.26")(3)
08	48"	(45.95")(3)
09	54"	(51.7")(3)
10	60"	(57.26")(3)
11	66"	(62.95")(3)
12	72"	(68.7")(3)
13	78"	(79.95")(3)
14	84"	(85.7")(3)
15	90"	(91.26")(3)
16	96"	(96.95")(3)

8. ELECTRICAL FEED
2 End feed
3 Right side feed
4 Left side feed
5 Bottom feed
FOR CONTINUOUS ROW
2-2 Right end feed
Left end feed
3-4 Right side feed
Left side feed
5-5 Right bottom feed
Left bottom feed

9. VOLTAGE / DIMMING
1 120v
2 277v
3 120v w/dim
4 277v w/dim
5 Other

10. SPECIFY DRIVER / DIMMING
Note: Reference **io** power supply specification sheet for driver and dimming options. If left blank, **io** will supply 100 watt drivers. Download Power Supply specification sheet from **www.iolighting.com**

Footnotes

Footnotes
1. Refer to conversion table for output.
2. White light variance between LED's within a single fixture will not exceed +/- 200k.
3. "Actual" length provided includes end feed and non-feed endcaps. Add .27 to each length when electrical feeds occur on both endcaps (for continuous row mounting).

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ADVANCE

XITANIUM
LED Drivers

Universal Outdoor Drivers for 12V and 24V LED systems

Applications

Orientation/Step Lighting

Architectural Lighting

Channel Letters

Contour Lighting

Edge Lighting

LEDs have evolved into a practical, flexible light source for a wide variety of illumination applications. Common LED products available in the market today are configured in a series-parallel array – designed to be powered by a suitable 24vdc driver – which allows flexibility to connect variable load levels. These operating voltages have become the standard in the industry.

The Brain Behind the Bright Idea

Xitanium LED drivers from Advance are designed specifically for 24V LED systems and incorporate features that enable broad commercialization of end-use solid-state lighting products.

Features	Benefits
UL Class 2	Limited output voltage and current plus isolation for safe operation
UL Outdoor Damp location rated - IP 66	Fully potted for moisture resistance and thermal benefits
Ultra small, compact size	Facilitates new, low-profile fixture design
Extreme low temperature Performance (-40°C)	Allows use in any outdoor application
Generous high temperature capability (+60°C)	Margin flexibility to facilitate fixture design
Tightly regulated output (1% line, 5% load)	Consistent light output across line and load levels
5 year warranty	Peace of mind for your new products and for end users…from the industry's most trusted component maker
Powered by Advance	Advance is preferred by end users – Enhance the value of your product

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Quick Selection Table

Catalog Number	Description	Application
LEDINTA0024V41FO	Intellivolt 100 Watt 24Vdc Outdoor	• 24Vdc LED Systems

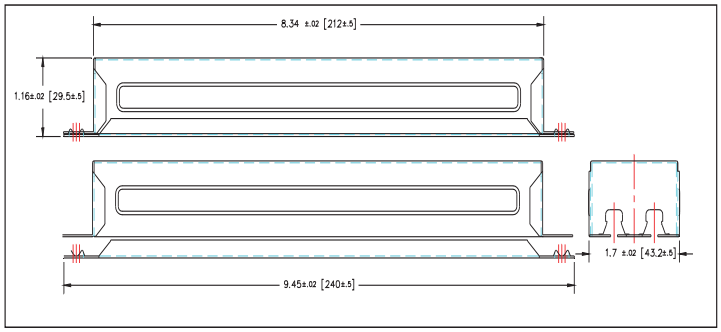
LED Driver Specifications

Description	Catalog Number	Input			Output			Case Temp Max (°C)	Figure	Weight (Grams)
		Volts (V)	Power Max (W)	Current Max (A)	Power Max (W)	Voltage Nom (V)	Current Max (A)			
100 Watt	LEDINTA0024V41FO	120	117.0	0.98	100.0	24.0	4.1	90	A	640
		230		0.51						
		277		.042						

Total Harmonic Distortion: 20% max
Power Factor: 90% min
Line Regulation: 1% output variation across input voltage range
Load Regulation: 5% output variation across input voltage range
Current Crest Factor: 1.5 max
Environmental Protection: IP66 outdoor rated
EMI: FCC47 SubPart15, CISPR15 and CISPR22 Class A
Protection: Meet UL1310 for Class 2; Inherent short-circuit protection, self-limited; overload protected; 3.2KV output insulation
AC Input and DC Output: 2 (0.78mm²) Solid Copper Wires, 15cm long

Dimensions

Fig. A

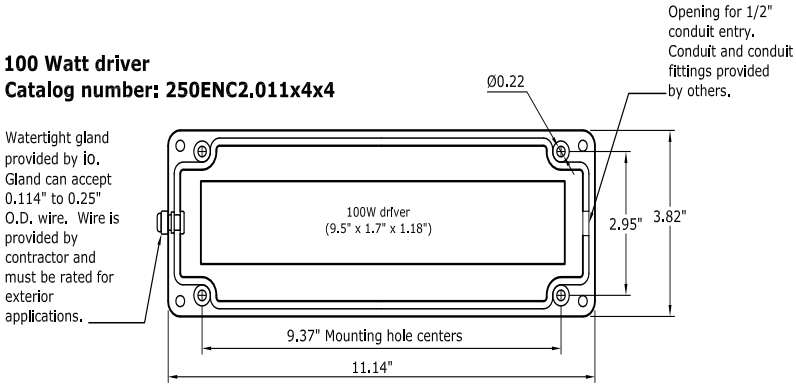


Advance, A Division of Philips Electronics North America · 10275 W Higgins Road · Rosemont, IL 60018 · USA
Tel: + 1 847 390-5205 · Fax: + 1 847 390-5264 · Revised 09/05PJJ

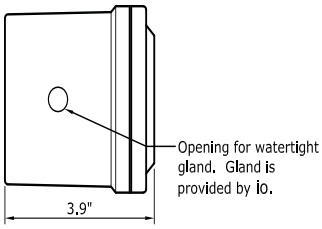
line

100W driver enclosure

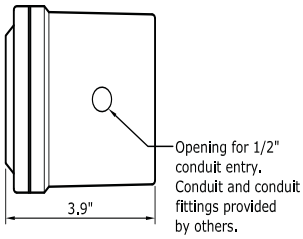
100 Watt driver
Catalog number: 250ENC2.011x4x4



Front view without cover



Left end view with cover



Right end view with cover

Enclosure Construction

Enclosure material is a molded fiberglass reinforced polyester (thermoset). The gasket is poured polyurethane seamless gasket that provides watertight, dust-tight environmental seal. The cover screws are recessed, captive and stainless steel.

Enclosure Industry Standards

UL/cUL 50	File E64358 type 1, 3, 4X, 6P, 12
NEMA 250	Type 1, 3, 4X, 6P, 12
CSA Std 22.2	File LR069014 type 1, 3, 4X, 6P, 12
Temp rating	(-40°C to +120°C)
Flammability rating	UL94-5V

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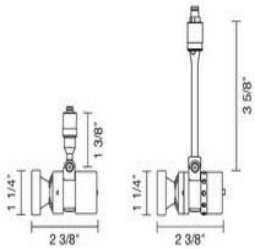
LEDRA™ II

Description:
The Ledra II is a fully adjustable Uni-Light fixture. Integral AC/DC converter allows fixture to work on all Bruck tracks with standard 12VAC transformers. Fixture works with electronic transformer but, must meet minimum 20% load. Internal dimming, through integral 32-step switching, controls on each fixture for precise setting. The small size, long life, lack of UV, and cool beam makes the Ledra II ideal for displays, casework, difficult to maintain locations, and applications requiring efficient rich color accents. Ledra II may only be used with a magnetic transformer.



Technical Specs:
Finish: matte chrome and bronze
Power consumption: 6.5 Watts
Drive current: 700mA
Lumen output: 65 at 700mA
Lamp life: 70% at 50,000hrs
5500 White with Luxeon III Star LED
3200 Warm White with Z- Power LED

Part Numbers:

135711/s	white 5000K, 10° lens, 1 3/8" stem
135711/m	white 5000K, 30° lens, 1 3/8" stem
135711/fl	white 5000K, 45° lens, 1 3/8" stem
135711bz/s	bronze, white 5000K, 10° lens, 1 3/8" stem
135711bz/m	bronze, white 5000K, 30° lens, 1 3/8" stem
135711bz/fl	bronze, white 5000K, 45° lens, 1 3/8" stem
135711-1/s	white 3000K, 10° lens, 1 3/8" stem
135711-1/m	white 3000K, 30° lens, 1 3/8" stem
135711-1/fl	white 3000K, 45° lens, 1 3/8" stem
135711-1bz/s	bronze, white 3000K, 10° lens, 1 3/8" stem
135711-1bz/m	bronze, white 3000K, 30° lens, 1 3/8" stem

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135711-1bz/fl	bronze, white 3000K, 45° lens, 1 3/8" stem
135713/s	white 5000K, 10° lens, 3 5/8" stem
135713/m	white 5000K, 30° lens, 3 5/8" stem
135713/fl	white 5000K, 45° lens, 3 5/8" stem
135713bz/s	bronze, white 5000K, 10° lens, 3 5/8" stem
135713bz/m	bronze, white 5000K, 30° lens, 3 5/8" stem
135713bz/fl	bronze, white 5000K, 45° lens, 3 5/8" stem
135713-1/s	white 3000K, 10° lens, 3 5/8" stem
135713-1/m	white 3000K, 30° lens, 3 5/8" stem
135713-1/fl	white 3000K, 45° lens, 3 5/8" stem
135713-1bz/s	bronze, white 3000K, 10° lens, 3 5/8" stem
135713-1bz/m	bronze, white 3000K, 30° lens, 3 5/8" stem
135713-1bz/fl	bronze, white 3000K, 45° lens, 3 5/8" stem

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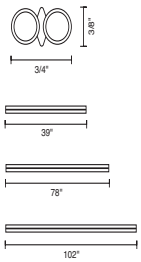
V/A TRACK

The V/A track consists of 2 extruded copper pipes with galvanized surface in chrome, bronze, gold or matte chrome. The plastic insulation is either black or grey.

STRAIGHT TRACK

12V | MAX 300W | SINGLE CIRCUIT



BZ	160031bz	39″
CH	160031ch	39″
G	160031g	39″
MC	160031mc	39″
BZ	160032bz	78″
CH	160032ch	78″
G	160032g	78″
MC	160032mc	78″
BZ	160033bz	102″
CH	160033ch	102″
MC	160033mc	102″

CURVED TRACK

12V | MAX 300W | SINGLE CIRCUIT

Custom curved V/A track bent horizontally or vertically in any radius from 2′ 6″ to 100′.

	horizontal curve	
BZ	160019-1bz	67″
CH	160019-1ch	67″
G	160019-1g	67″
MC	160019-1mc	67″
	horizontal curve	
BZ	160019-2bz	94″
CH	160019-2ch	94″
MC	160019-2mc	94″
	vertical curve	
BZ	160019-3bz	67″
CH	160019-3ch	67″
MC	160019-3mc	67″
	vertical curve	
BZ	160019-4bz	94″
CH	160019-4ch	94″
MC	160019-4mc	94″

END CAP

BK	160020blk
MC	160020mc

DEBURRING TOOL

160400

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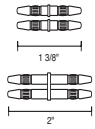
TRACK CONNECTOR / ISO CONNECTOR

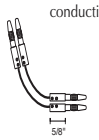
160402	conductive	CH
160409blk	isolator	BK
160409mc	isolator	MC



FLEXIBLE TRACK CONNECTOR

conductive

160501bz	55º-130º	BZ
160501ch	55º-130º	CH
160501g	55º-130º	G
160501mc	55º-130º	MC

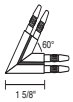


HORIZONTAL ANGLE CONNECTOR

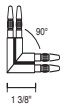
conductive

N 160411bz	45º	BZ
160411ch	45º	CH
160411g	45º	G
160411mc	45º	MC

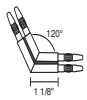
N 160420bz	60º	BZ
160420ch	60º	CH
160420g	60º	G
160420mc	60º	MC



160406bz	90º	BZ
160406ch	90º	CH
160406g	90º	G
160406mc	90º	MC



N 160421bz	120º	BZ
160421ch	120º	CH
160421g	120º	G
160421mc	120º	MC



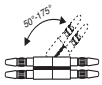
N 160408bz	135º	BZ
160408ch	135º	CH
160408g	135º	G
160408mc	135º	MC

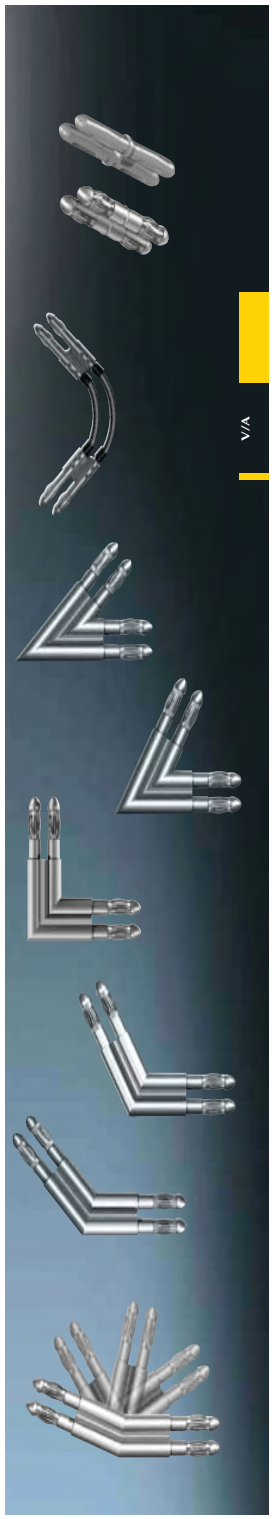
CUSTOM HORIZONTAL ANGLE CONNECTOR

conductive

custom angle in 5º increments, specify when ordering

N 160830bz	45º-180º	BZ
160830ch	45º-180º	CH
160830g	45º-180º	G
160830mc	45º-180º	MC





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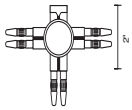
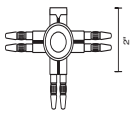
V/A CONNECTORS

HORIZONTAL T-CONNECTOR

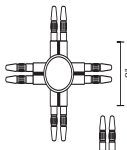


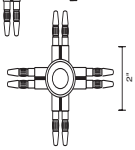


suspendable

BZ	N 160414bz	T-Connector
CH	160414ch	T-Connector
G	160414g	T-Connector
MC	160414mc	T-Connector
for use with 160605		
BZ	N 160416bz	T-Connector
CH	N 160416ch	T-Connector
G	N 160416g	T-Connector
MC	N 160416mc	T-Connector

HORIZONTAL CROSS CONNECTOR



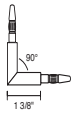


suspendable

BZ	N 160404bz	Cross Connector
CH	160404ch	Cross Connector
G	160404g	Cross Connector
MC	160404mc	Cross Connector
for use with 160605		
BZ	N 160412bz	Cross Connector
CH	N 160412ch	Cross Connector
G	N 160412g	Cross Connector
MC	N 160412mc	Cross Connector

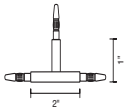
VERTICAL ANGLE CONNECTOR

conductive



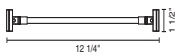
BZ	N 160407bz	90º
CH	160407ch	90º
G	160407g	90º
MC	160407mc	90º

BZ	N 160410bz	135º
CH	160410ch	135º
G	160410g	135º
MC	160410mc	135º



BZ	N 160403bz	T-Connector
CH	160403ch	T-Connector
G	160403g	T-Connector
MC	160403mc	T-Connector

TRACK SPACER



BZ	160210bz	12 1/4″
CH	160210ch	12 1/4″
G	N 160210g	12 1/4″
MC	160210mc	12 1/4″

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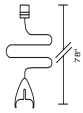
CORD SUSPENSION CLIP

aircraft cable with clamp adaptor

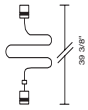
N 160600bz	78″	BZ
N 160600ch	78″	CH
N 160600g	78″	G
N 160600mc	78″	MC



CORD SUSPENSION II

for use with 160412 or 160416

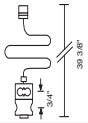
N 160605ch	39 3/8″	CH
N 160605mc	39 3/8″	MC



CORD SUSPENSION CROSS CONNECTOR

aircraft cable with clamp adaptor

160206ch	39 3/8″	CH
160206mc	39 3/8″	MC

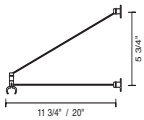


WALL & CEILING ATTACHMENT CLIP

160518bz	1″	BZ
160518ch	1″	CH
160518g	1″	G
160518mc	1″	MC
160519blk	3/8″	BK
160519mc	3/8″	MC

WALL EXTENSION ARM CLIP

160560bz	11 3/4″	BZ
160560ch	11 3/4″	CH
160560mc	11 3/4″	MC
160561bz	20″	BZ
160561ch	20″	CH
160561mc	20″	MC



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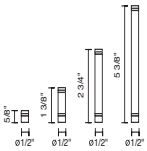
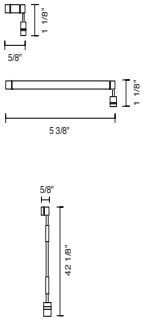
V/A MOUNTING SUPPORTS

SPACER



BZ	N 160430bz	5/8″
CH	160430ch	5/8″
G	160430g	5/8″
MC	160430mc	5/8″
BZ	N 160530bz	1 3/8″
CH	160530ch	1 3/8″
G	160530g	1 3/8″
MC	160530mc	1 3/8″
BZ	160531bz	2 3/4″
CH	160531ch	2 3/4″
G	160531g	2 3/4″
MC	160531mc	2 3/4″
BZ	N 160532bz	5 3/8″
CH	160532ch	5 3/8″
G	160532g	5 3/8″
MC	160532mc	5 3/8″

WALL SUSPENSION



CH	160565ch	5/8″
MC	160565mc	5/8″
CH	160566ch	5 3/8″
MC	160566mc	5 3/8″
CH	160580ch	42″ 1/8″
MC	160580mc	42″ 1/8″

PLATE DISC

BZ	160533bz
CH	160533ch
G	160533g
MC	160533mc

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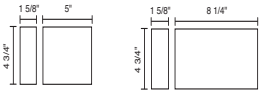
TC2 ELECTRONIC TRANSFORMER

Class II with 5A breakers included

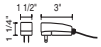
TC2-150/120v	3 x 50W, 120V
TC2-300/120v	6 x 50W, 120V



T-60 PLUG-IN TRANSFORMER

electronic transformer for standard wall sockets

70403	60W, 120V	BLK



PLUG-IN TRANSFORMER FOR LEDRA FIXTURES

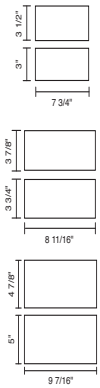
short circuit and overload protected, output DC 12V 700mA max, UL listed

70423	120V/250V	BLK

T REMOTE TRANSFORMER

2 secondary taps with circuit breaker included in housing, for separate switching separate transformers should be used, choke optional

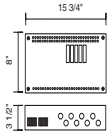
T-150/120v	150W, 120V	BLK
T-300/120v	300W, 120V	MC
T-300/277v	300W, 277V	MC
T-600/120v	2 x 300W, 120V	MC
T-600/277v	2 x 300W, 277V	MC
TCK-300	choke for 300W transformer	
TCK-600	choke for 600W transformer	



TQ REMOTE/SURFACE TRANSFORMER

4 secondary taps with primary and secondary circuit breaker included, zero clearance requirement, choke optional for dimming

TQ-150/120v	150W, 120V	WH
TQ-300/120v	300W, 120V	WH
TQ-300/277v	300W, 277V	WH
TQ-600/120v	2 x 300W, 120V	WH
TQ-600/277v	2 x 300W, 277V	WH
TCK-300	choke for 300W transformer	
TCK-600	choke for 600W transformer	



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END OF SECTION