TAB C
TECHNICAL DESIGN GUIDELINES

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UNLV | PLANNING & CONSTRUCTION

Technical Design Guidelines

TAB C: TECHNICAL DESIGN GUIDELINES
TABLE OF CONTENTS

SECTION 2

SECTION 3

SECTION 4

SECTION 5

SECTION 6

SECTION 7

SECTION 8

SECTION 9

SECTION 10

SECTION 11

SECTION 12

SECTION 13

SECTION 14

SECTION 15

SECTION 16

SECTION 02080

ASBESTOS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

The work covered by this section includes the handling and control of asbestos-containing materials and describes some of the resultant procedures and equipment required to protect workers, the environment and occupants of the building or area, or both, from contact with airborne asbestos fibers. The work also includes the disposal of any asbestos-containing materials generated by the work. More specific operational procedures shall be outlined in the Asbestos Hazard Abatement Plan called for elsewhere in this specification.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

References

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z88.2	(1992) Respiratory Protection
ANSI Z9.2	(2001) Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems

ASTM INTERNATIONAL (ASTM)

ASTM D 1331	(1989; R 2001) Surface and Interfacial Tension of Solutions of Surface-Active Agents

NEVADA ADMINISTRATIVE CODE (NAC)

NAC 618	Occupational Safety and Health

NEVADA REVISED STATUTES (NRS)

NRS 618	Occupational Safety and Health

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA560/5-85-024	(1985) Guidance for Controlling Asbestos-Containing Materials in Buildings (Purple Book)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926.103	Respiratory Protection

29 CFR 1926.1101	Asbestos
29 CFR 1926.200	Accident Prevention Signs and Tags
29 CFR 1926.51	Sanitation
29 CFR 1926.59	Hazard Communication
40 CFR 61	SUBPART A - General Provisions
40 CFR 61	SUBPART M - National Emission Standard for Asbestos
40 CFR 763	Asbestos

UNDERWRITERS LABORATORIES (UL)

UL 586	(1996; Rev thru Aug 2004) Standard for High-Efficiency Particulate, Air Filter Units

Definitions

Abatement - Procedures to control fiber release from asbestos-containing material or asbestos-containing building material.

ACM - Asbestos-Containing Material.

Amended Water - Water containing a wetting agent or surfactant with a maximum surface tension of 29 dynes per centimeter when tested in accordance with ASTM D 1331.

Asbestos - The term asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, and actinolite asbestos and any of these minerals that has been chemically treated or altered. Materials are considered to contain asbestos if the asbestos content of the material is determined to be at least one percent.

Asbestos Permissible Exposure Limit - 0.1 fibers per cubic centimeter of air as an 8-hour time weighted average measured in the breathing zone as defined by 29 CFR 1926.1101.

Authorized Visitor - Any visitor to the site whose visit has been authorized by the owner.

Contractor - The Contractor is that individual, or entity under contract to UNLV to perform the herein listed work.

Competent Person - A person meeting the requirements for competent person as specified in 29 CFR 1926.1101. The competent person shall be a supervisor licensed by the Enforcement Section in accordance with NAC 618.

Encapsulation - The abatement of an asbestos hazard through the appropriate use of chemical encapsulants.

Encapsulants - Specific materials in various forms used to chemically or physically entrap asbestos fibers in various configurations to prevent these fibers from becoming airborne. There are four types of encapsulants as follows which must comply with performance requirements as specified herein.

Removal Encapsulant (can be used as a wetting agent)

Bridging Encapsulant (used to provide a tough, durable surface coating to asbestos containing material)

Penetrating Encapsulant (used to penetrate the asbestos containing material encapsulating all asbestos fibers and preventing fiber release due to routine mechanical damage)

Lock-Down Encapsulant (used to seal off or "lock-down" minute asbestos fibers left on surfaces from which asbestos containing material has been removed).

Friable Asbestos Material - One percent (or greater) asbestos-containing material that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

Glovebag Technique - Those asbestos removal and control techniques put forth in 29 CFR 1926.1101 Appendix G.

*HEPA Filter Equipmen*t - High efficiency particulate air (HEPA) filtered vacuum and/or exhaust ventilation equipment with a filter system capable of collecting and retaining asbestos fibers. Filters shall retain 99.97 percent of particles 0.3 microns or larger as indicated in UL 586.

Negative Pressure Enclosure (NPE) - That engineering control technique described as a negative pressure enclosure in 29 CFR 1926.1101.

Non-friable Asbestos Material - Material that contains asbestos in which the fibers have been immobilized by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not normally release asbestos fibers during any appropriate use, handling, storage or transportation.

Owner - The University, hereinafter referred to as the Owner or UNLV, or the authorized representative of the Owner, or the consultant.

Personal Sampling - Air sampling which is performed to determine asbestos fiber concentrations within the breathing zone of a specific employee, as performed in accordance with 29 CFR 1926.1101.

Time Weighted Average (TWA) - The TWA is an 8-hour time weighted average airborne concentration of asbestos fibers.

Wetting Agent - A chemical added to water to reduce the water's surface tension thereby increasing the water's ability to soak into the material to which it is applied. An equivalent wetting agent must have a surface tension of at most 29 dynes per centimeter when tested in accordance with ASTM D 1331.

Intent

These specifications are intended to describe and illustrate all material, labor, and equipment necessary for asbestos removal. These specifications and accompanying drawings represent the Owner's best estimate of the extent and presence of asbestos-containing or asbestos-contaminated material in the campus facilities. It is the responsibility of the Contractor to determine the precise lineal footage, number of fittings, and/or square footage of asbestos-containing material. No extra compensation will be allowed for differences between the "best estimate" and the Contractor's field determination of actual pipe routing or configuration, paper size, number of fittings, lineal footage, square footage, etc. By these documents, the Contractor shall properly remove all asbestos-containing material from the areas designated on the drawings.

Each bidder will be held to have examined the premises and satisfied himself with the conditions which would in any manner affect the work under the contract, and no later claims for extra compensation for labor, materials, and equipment which could have been foreseen by such examination will be recognized. The Contractor shall take all necessary measurements for his work at the site and shall verify all measurements given on the drawings.

Requirements

Water - Existing service is available for the Contractor's use. Utility charges for water service will be paid by the Owner.

Electrical Service - Provide temporary service for all Contractor operations. Contractors shall be responsible for furnishing such light bulbs, temporary lighting, and extension cords as may be essential to the execution of their respective branches of the work, and for extensions of lines to sheds or to power tools, and remote areas that cannot be reached with extension cords.

Contractor shall be responsible for replacement cost of transformers, panels, circuit breakers, and any other item(s) of electrical equipment and installation thereof which is destroyed or broken as a result of or during the course of the Contractor's abatement activity.

Job Telephone - Contractor shall provide and pay for his/her telephone service at the site.

Medical Requirements - Provide medical requirements including but not limited to medical surveillance and medical record keeping as listed in 29 CFR 1926.1101.

Medical Examinations - Before exposure to airborne asbestos fibers, provide workers with a comprehensive medical examination as required by 29 CFR 1926.1101 or other pertinent State or local directives. This requirement must have been satisfied within the 12 months prior to the start of work on this contract.

Medical Records - Maintain complete and accurate records of employees' medical examinations, medical records, and exposure data for a period of 30 (REV 02) years after termination of employment.

Employee Training - Submit certificates indicating that employees have received training in the proper handling of materials and wastes that contain asbestos in accordance with 40 CFR 763. Furnish each employee with respirator training and fit testing as required by 29 CFR 1926.1101.

Permits, Licenses, and Notifications - Obtain necessary permits and licenses in conjunction with asbestos removal, encapsulation, hauling, and disposition, and furnish notification of such actions required by Federal, State, and local authorities prior to the start of work. When applicable, notify the local fire department 3 days prior to removing fire-proofing material from the building including notice that the material contains asbestos.

Environment, Safety and Health Compliance - In addition to detailed requirements of this specification, comply with those applicable laws, ordinances, criteria, rules, and regulations of Federal, State, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926.1101, 40 CFR 61-SUBPART A, and 40 CFR 61-SUBPART M. Submit matters of interpretation of standards to the UNLV Project Manager for resolution before starting the work. Where the requirements of this specification, applicable laws, rules, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirement as defined by the UNLV shall apply.

Respiratory Protection Program - Establish and implement a respirator program as required by ANSI Z88.2, 29 CFR 1926.1101, and 29 CFR 1926.103.

Respirator Program Records - Maintain records of the respirator program as required by ANSI Z88.2, 29 CFR 1926.103, and 29 CFR 1926.1101.

Asbestos Hazard Control Supervisor - The Contractor shall be represented on-site at all times by a supervisor, trained using the model Contractor accreditation plan as indicated in the Federal statutes for all portions of the herein listed work.

Hazard Communication - Adhere to all parts of 29 CFR 1926.59 and provide the UNLV Project Manager with a copy of the Material Safety Data Sheets (MSDS) for all materials brought to the site.

Asbestos Hazard Abatement Plan - Submit a detailed plan of the safety precautions such as lockout/tagout, fall protection, confined space entry procedures, and equipment and work procedures to be used in the removal and disposal of materials containing asbestos. The plan, not to be combined with other hazard abatement plans, shall be prepared and signed by an AHERA accredited Project Designer. Such plan shall include, but not be limited to, the precise personal protective equipment to be used, respiratory protection, type of whole-body protection, the location of asbestos control areas (including clean and dirty areas), buffer zones, showers, storage areas, change rooms, abatement method, sequencing of asbestos related work, disposal plan, type of wetting agent and asbestos sealer to be used, locations of local exhaust equipment, planned air monitoring strategies, and a detailed description of the method to be employed in order to control environmental pollution. The plan shall also include fire and medical emergency response plans. Once approved by the UNLV Project Manager, the plan will be enforced as if an addition to the specification. Any changes required in the specification as a result of the plan shall be identified specifically in the plan to allow for free discussion and approval by the UNLV Project Manager prior to starting work.

Testing Laboratory - Submit the name, address, and telephone number of each testing laboratory selected for the sampling, analysis, and reporting of airborne concentrations of asbestos fibers along with evidence that each laboratory selected holds the appropriate State license and/or permits and certification that each laboratory is American Industrial Hygiene Association (AIHA) accredited and that persons counting the samples have been judged proficient by current inclusion on the AIHA Asbestos Analysis Registry (AAR) and successful participation of the laboratory in the Proficiency Analytical Testing (PAT) Program. Where analysis to determine asbestos content in bulk materials or transmission electron microscopy is required, submit evidence that the laboratory is accredited by the National Institute of Science and Technology (NIST) under National Voluntary Laboratory Accreditation Program (NVLAP) for asbestos analysis. The testing laboratory firm shall be independent of the asbestos contractor and shall have no employee or employer relationship which could constitute a conflict of interest.

Landfill Approval - Submit written evidence that the landfill is approved for asbestos disposal by the U.S. Environmental Protection Agency and local regulatory agencies. Within 3 working days after delivery, submit detailed delivery tickets, prepared, signed, and dated by an agent of the landfill, certifying the amount of asbestos materials delivered to the landfill. Submit a copy of the waste shipment records within 1 day of the shipment leaving the project site.

Medical Certification - Provide a written certification for each worker and supervisor, signed by a licensed physician indicating that the worker and supervisor has met or exceeded all of the medical prerequisites listed herein and in 29 CFR 1926.1101 and 29 CFR 1926.103 as prescribed by law.

SUBMITTALS

UNLV approval and acceptance is required for the following submittals:

Local exhaust ventilation equipment

Respirators to be used

Pressure differential automatic recording instrument

Amended water specifications

Glovebags (if applicable)

Material Safety Data Sheets (MSDS) for all materials proposed for transport to the project site

Encapsulants

Air sampling results (during and post-event)

Pressure differential recordings for local exhaust system (during abatement)

Asbestos disposal quantity report (post event)

Asbestos hazard abatement plan

Testing Laboratory qualifications

Competent person documentation

Worker’s licenses

Employee training records

Landfill approval

Medical surveillance documentation

Waste shipment records and if applicable exemption report

Written respiratory protection program

Water filtration equipment

Vacuums

Show compliance with ANSI Z9.2 by providing manufacturers' certifications.

Notifications

Rental equipment

DOP testing records

MATERIALS

Rental Equipment - Provide a copy of the written notification to the rental company concerning the intended use of the equipment and the possibility of asbestos contamination of the equipment.

Encapsulants - Shall conform to current USEPA requirements and shall contain no toxic or hazardous substances as defined in 29 CFR 1926.59.

INSTALLATION GUIDELINES

Equipment - At all times, provide the UNLV Project Manager with at least two complete sets of personal protective equipment as required for entry to and inspection of the asbestos control area.

Respirators - Select respirators from those approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services.

Respirators for Handling Asbestos - Provide personnel engaged in pre-cleaning, cleanup, handling, encapsulation, removal, or demolition of asbestos materials with respiratory protection as indicated in 29 CFR 1926.1101 and 29 CFR 1926.103.

Outer Protective Clothing - Provide personnel exposed to asbestos with disposable "non-breathable" whole body outer protective clothing, head coverings, gloves, and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort, but shall not be used alone.

Personal Decontamination Area - The employer shall establish a decontamination area that is adjacent and connected to the regulated area for decontamination of employees. The decontamination area shall consist of an equipment room, shower area, and clean room in series. The employer shall ensure that employees enter and exit the regulated area through the decontamination area. Collect used shower water and filter with approved water filtration equipment to remove asbestos contamination. Dispose of filters and residue as asbestos waste. Discharge clean water to the sanitary system. Dispose of asbestos contaminated work clothing as asbestos contaminated waste or properly decontaminate as specified in the Contractor's Asbestos Hazard Abatement Plan. Decontamination units shall be physically attached to the asbestos control area. (REV 02)

Eye Protection - Provide eye protection (REV 02) to personnel engaged in asbestos abatement operations when the use of a full face respirator is not required.

Warning Signs and Labels - The employer shall ensure that employees working in and contiguous to regulated areas comprehend warning signs required to be posted. Means to ensure employee comprehension may include the use of foreign languages, pictographs and graphics. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide labels and affix to all asbestos materials, scrap, waste, debris, and other products contaminated with asbestos. (REV 02)

Warning Sign - Provide vertical format conforming to 29 CFR 1926.200 and 29 CFR 1926.1101.

Warning Labels - Provide labels conforming to 29 CFR 1926.1101 of sufficient size to be clearly legible.

Local Exhaust System - Provide an adequate local exhaust system in the asbestos control area in accordance with ANSI Z9.2 and 29 CFR 1926.1101 that will provide at least four air changes per hour inside of the negative pressure enclosure and maintain a minimum pressure differential in the control area of -0.02 inches of water column relative to adjacent, unsealed areas. Local exhaust equipment shall operate 24 hours per day, until the asbestos control area is removed and shall be leak proof to the filter and equipped with HEPA filters. Maintain a minimum pressure differential in the control area of minus -0.02 inches of water column relative to adjacent, unsealed areas. In no case shall the building ventilation system be used as the local exhaust system for the asbestos control area. Filters on exhaust equipment shall conform to ANSI Z9.2 and UL 586. The local exhaust system shall terminate out of doors and remote from any public access or ventilation system intakes. Contractor is responsible for providing emergency power in order to maintain local exhaust system. (REV 02)

Tools - Vacuums shall be leak proof to the filter and equipped with HEPA filters. Filters on vacuums shall conform to ANSI Z9.2 and UL 586. Do not use power tools to remove asbestos-containing materials unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation systems. Remove all residual asbestos from reusable tools prior to storage or reuse.

Glovebags - Submit written manufacturers proof that glovebags will not break down under expected temperatures and conditions.

Work Procedure - Perform asbestos related work in accordance with 29 CFR 1926.1101, 40 CFR 61-SUBPART M, and as specified herein. Use wet removal procedures and appropriate encapsulation procedures as listed in the accepted asbestos hazard abatement plan. Personnel shall wear and utilize protective clothing and equipment as specified herein. Eating, smoking, drinking, chewing gum, tobacco, or applying cosmetics shall not be permitted in the asbestos work or control areas.

Coordinate with UNLV Facilities Department with regard to shutting down the building heating, ventilating, and air conditioning system prior to the commencement of asbestos work. When applicable, seal all roof top penetrations, except plumbing vents, prior to asbestos roofing work. Coordinate with UNLV Facilities Department to disconnect electrical service when encapsulation or wet removal is performed and provide temporary electrical service with verifiable ground fault circuit interrupter (GFCI) protection. If an asbestos fiber release or spill occurs outside of the asbestos control area, stop work immediately, correct the condition to the satisfaction of the UNLV Project Manager including clearance sampling, prior to resumption of work.

Protection of Existing Work to Remain - Perform work without damage or contamination of adjacent work. Where such work is damaged or contaminated as verified by the UNLV Project Manager using visual inspection or sample analysis, it shall be restored to its original condition or decontaminated by the Contractor at no expense to UNLV as deemed appropriate by the UNLV Project Manager. This includes inadvertent spill of dirt, dust, or debris in which it is reasonable to conclude that asbestos may exist. When these spills occur, stop work immediately. Then clean up the spill. When satisfactory visual inspection and air sampling results are obtained work may proceed at the discretion of the UNLV Project Manager.

Furnishings - Where applicable, furniture and equipment will be removed from the area of work by UNLV before asbestos work begins.

Pre-cleaning - Wet wipe and HEPA vacuum all surfaces potentially contaminated with asbestos prior to establishment of an enclosure.

Negative Pressure Enclosure - The Contractor shall seal all openings in areas where the release of airborne asbestos fibers can be expected. Establish a negative pressure enclosure with the use of curtains, portable partitions, or other enclosures in order to prevent the escape of asbestos fibers from the contaminated asbestos work area. Negative pressure enclosure development shall include protective covering of uncontaminated walls and ceilings with at least two layers of minimum 6-mil plastic sheeting sealed with tape or other adhesives which have sufficient strength to support the weight of the material and provide protection from water damage. Provide at least two layers of 6-mil plastic sheeting over floors and extend a minimum of 12 inches up walls. Seal all joints with tape. Openings will be allowed in enclosures of asbestos control areas for personnel and equipment entry and exit, the supply and exhaust of air for the local exhaust system and the removal of properly containerized asbestos containing materials. Replace local exhaust system filters as required to maintain the efficiency of the system.

Glovebag (when applicable) When the construction of a negative pressure enclosure is infeasible, for the removal of asbestos-containing thermal system insulation, use an alternate technique as indicated in 29 CFR 1926.1101. Establish designated limits for the asbestos regulated area with the use of a continuous barrier and maintain all other requirements for asbestos control areas. The Contractor shall conduct daily monitoring that is representative of the exposure of each employee who is assigned to work within the asbestos control area throughout the duration of the project. If the quantity of airborne asbestos fibers monitored at the breathing zone of the workers at any time exceeds background or 0.01 fibers per cubic centimeter whichever is greater, stop work, evacuate personnel in adjacent areas or provide personnel with approved protective equipment at the discretion of the UNLV Project Manager. (REV 02)

General Removal Procedures - The Contractor shall adequately wet the asbestos material with a fine spray of amended water during removal, cutting, or other handling so as to reduce the emission of airborne fibers. Prompt clean-up and disposal of wastes and debris contaminated with asbestos into leak tight containers shall be employed during the entire removal process. (REV 02)

Sealing Contaminated Items Designated for Disposal (when applicable) - As indicated on abatement drawings: Remove contaminated architectural, mechanical, and electrical appurtenances such as venetian blinds, full-height partitions, carpeting, duct work, pipes and fittings, radiators, light fixtures, conduit, panels, and other contaminated items designated for removal shall be wrapped and then disposed of as asbestos waste. (REV 02)

Exposed Pipe Insulation Edges (when applicable) Contain edges of asbestos insulation to remain that are exposed by a removal operation. Wet and cut the rough ends true and square with sharp tools and then encapsulate the edges with a 1/4 inch thick layer of non-asbestos containing insulating cement troweled to a smooth hard finish. When cement is dry, lag the end with a layer of non-asbestos lagging cloth, overlapping the existing ends by at least 4 inches. When insulating cement and cloth is an impractical method of sealing a raw edge of asbestos, take appropriate steps to seal the raw edges as approved by the UNLV Project Manager.

Air Sampling - Sampling of airborne concentrations of asbestos fibers shall be performed in accordance with 29 CFR 1926.1101 and as specified herein. Sampling performed in accordance with 29 CFR 1926.1101 shall be performed by the Contractor. Sampling performed for environmental and quality control reasons shall be performed by UNLV or a third party consultant retained by UNLV. Unless otherwise specified, use NIOSH Method 7400 for sampling and analysis. (REV 02)

Sampling Prior to Asbestos Work - Area air sampling shall be conducted prior to the construction of the negative pressure enclosure by UNLV or a third party consultant to establish the baseline one day prior to the masking and sealing operations for each asbestos removal worksite. (REV 02)

Sampling During Asbestos Work - The Contractor shall conduct personal sampling as indicated in 29 CFR 1926.1101. Area air samples shall be collected at the entrance to the decontamination chamber, at the point of exhaust of the local exhaust system and in random areas outside the enclosure. If sampling outside the enclosure shows airborne levels have exceeded background or 0.01 fibers per cubic centimeter, whichever is greater, UNLV shall issue a stop-work order. (REV 02)

Sampling After Final Clean-Up (Clearance Sampling) - A third party representative shall collect area samples using aggressive air sampling techniques as defined in the EPA 560/5-85-024 to establish an asbestos fiber concentration of less than 70 structures per square millimeter by use of transmission electron microscopy (TEM). Sample results shall be returned by the laboratory within 24 hours of the final air clearance sampling. After final cleanup and the asbestos control area is dry but prior to clearance sampling, the Contractor and a third party representative shall perform a visual inspection in accordance with ASTM E 1368 to ensure that the asbestos control and work area is free of any accumulations of dirt, dust, or debris. Should any of the final samples indicate a higher value, the Contractor shall take appropriate actions to re-clean the area and shall repeat the sampling and TEM analysis at the Contractor's expense. (REV 02)

Lock-Down - After final air clearance results have been accepted by UNLV and prior to the removal of the plastic barriers the Contractor shall evenly apply a lock-down encapsulant to the ceiling, walls, floors and other areas exposed in the removal area. The exposed area shall include but not be limited to plastic barriers, furnishings and articles to be discarded as well as dirty change room, air locks for bag removal and decontamination chambers. (REV 02)

Site Inspection - While performing asbestos engineering control work, the Contractor shall be subject to on-site inspection by the UNLV Project Manager who may be assisted by or represented by safety or industrial hygiene personnel. If the work is found to be in violation of this specification, the UNLV Project Manager or his representative will issue a stop work order to be in effect immediately and until the violation is resolved. All related costs including standby time required to resolve the violation shall be at the Contractor's expense.

Housekeeping - Essential parts of asbestos dust control are housekeeping and clean-up procedures. Maintain surfaces of the asbestos control area free of accumulations of asbestos fibers. Give meticulous attention to restricting the spread of dust and debris; keep waste from being distributed over the general area. Use HEPA filtered vacuum cleaners. DO NOT BLOW DOWN THE SPACE WITH COMPRESSED AIR. When asbestos removal is complete, all asbestos waste is removed from the work-site, and final clean-up is completed, the UNLV Project Manager will attest that the area is safe before the signs can be removed. Coordinate with the UNLV Facilities Management Department to re-establish HVAC mechanical and electrical systems in proper working order. The UNLV Project Manager will visually inspect all surfaces within the enclosure for residual material or accumulated dust or debris. The Contractor shall re-clean all areas showing dust or residual materials. If re-cleaning is required, air sample and establish an acceptable asbestos airborne concentration after re-cleaning. (REV 02)

Procedure for Disposal - Collect asbestos waste, asbestos-contaminated water, scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing which may produce airborne concentrations of asbestos fibers and place in sealed fiber-proof, waterproof, non-returnable containers (e.g. double plastic bags 6 mils thick, cartons, drums or cans). Wastes within the containers must be adequately wet in accordance with 40 CFR 61-SUBPART M. Affix a warning and Department of Transportation (DOT) label to each container including the bags or use at least 6 mils thick bags with the approved warnings and DOT labeling preprinted on the bag. The name of the waste generator and the location at which the waste was generated shall be clearly indicated on the outside of each container. Prevent contamination of the transport vehicle (especially if the transport vehicle is a rented truck likely to be used in the future for non-asbestos purposes). These precautions include lining the vehicle cargo area with plastic sheeting (similar to work area enclosure) and thorough cleaning of the cargo area after transport and unloading of asbestos debris is complete. Dispose of waste asbestos material at an Environmental Protection Agency (EPA) or State-approved asbestos landfill off UNLV property. Procedure for hauling and disposal shall comply with 40 CFR 61-SUBPART M, State, regional, and local standards. Sealed plastic bags may be dumped from drums into the burial site unless the bags have been broken or damaged. Damaged bags shall remain in the drum and the entire contaminated drum shall be buried. Uncontaminated drums may be recycled. Workers unloading the sealed drums shall wear appropriate respirators and personal protective equipment when handling asbestos materials at the disposal site. (REV 02)

Asbestos Disposal Quantity Report - Notify the UNLV Project Manager as to the amount of asbestos-containing material removed and released for disposal (daily). Deliver the report for the previous day at the beginning of each day shift with amounts of material removed during the previous day reported in linear feet or square feet as described initially in this specification and in cubic feet for the amount of asbestos-containing material released for disposal.

QUALITY CONTROL

Contractor's Project Designer - Submit the name, address, and telephone number of the Contractor's Project Designer selected to prepare the Asbestos Hazard Abatement Plan. (REV 02)

Competent Person Documentation - Submit training certification and a current State of Nevada Asbestos Contractor's and Supervisor's License.

Worker's License - Submit documentation that requires all workers have a current State of Nevada Asbestos Workers License.

Contractor's License - Contractor shall have current Nevada asbestos contractor's license. Submit a copy of the asbestos contractor's license issued by the State of Nevada.

Air Sampling Results - Complete fiber counting and provide results to the UNLV Project Manager for review within 16 hours of the "time off" of the sample pump. Notify the UNLV Project Manager immediately of any airborne levels of asbestos fibers in excess of the acceptable limits. Submit sampling results to the UNLV Project Manager and the affected Contractor employees where required by law within 3 working days. Notify the UNLV Project Manager immediately of any variance in the pressure differential which could cause adjacent unsealed areas to have asbestos fiber concentrations in excess of 0.01 fibers per cubic centimeter or background whichever is higher. In no circumstance shall levels exceed 0.1 fibers per cubic centimeter.

Pressure Differential Recordings for Local Exhaust System - Provide a pressure deferential recording device that is capable of providing a hard copy and able to upload information to a computer. The device must be capable of operating 24 hours a day until the asbestos controls are removed. Submit pressure differential recordings for each work day to the UNLV Project Manager within 24 hours from the end of each work day. (REV 02)

Protective Clothing Decontamination Quality Control Records - Provide all records that document quality control for the decontamination of reusable outer protective clothing.

Protective Clothing Decontamination Facility Notification - Submit written evidence that persons who decontaminate, store, or transport asbestos contaminated clothing used in the performance of this contract were duly notified in accordance with 29 CFR 1926.1101.

Final Report Documentation - The Contractor shall deliver one hard copy and one electronic copy of all reports and documents, including the final clearance to the UNLV Project Manager within ten working days of the completion of the asbestos abatement project. (REV 02)

WARRANTY

Guarantee - The Contractor and each Subcontractor shall guarantee that all materials and workmanship shall be free from original defects or against injury from proper and usual wear when used for purposes intended for one year after date of final certification.

The Contractor shall, in case of work performed by his Subcontractors and where guarantees are required, secure warranties from said subcontractors and deliver copies of same to the Owner upon completion of the work and prior to final retention payment.

All portions of the work shall also be maintained in perfect condition during this period. Such written guarantees as may be requested shall be submitted in duplicate at the completion of the work. These will be supplementary to and not in any way canceling specific guarantees which apply to various portion of the work.

If, in the Contractor's opinion, any work is shown on the drawings or called for in the specifications in such a manner as to make it impossible for him to produce and guarantee a first-class piece of work, he shall refer the same to the Owner before proceeding.

SECTION 02200

EARTHWORK

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for earthwork.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Consultant shall follow the earthwork design criteria as established in the geo-technical report. Any deviations from the Geo-Technical Report recommendations are required to be approved by both the Geo-Technical Engineer as well as the UNLV Project Manager.

Existing Utilities: Location of existing underground utilities shall be coordinated with both “Call Before You Dig” and UNLV Planning and Construction, as there are both utility and UNLV owned underground installations on campus.

Protect existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

Unclassified Excavation: Excavate to sub-grade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions. Revise this Article to suit Project.

Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by the project’s Architect of Record.

QUALITY CONTROL

Testing Agency: a qualified independent geotechnical engineering testing agency shall perform field quality-control testing.

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

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

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

CLEANING AND ADJUSTING

Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Campus property.

SECTION 02207

AGGREGATE MATERIAL

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SUMMARY

This section provides for aggregate materials as required by the Drawings, written instructions from the Engineer or Owner, and/or as required by other sections of this Section.

Work includes:

Aggregate materials for sub-grade preparation.

Aggregate materials for base material preparation.

RELATED DOCUMENTS

Documents affecting work off this Section include but are not necessarily limited to the Drawings (if applicable), UNLV written directions, UNLV Terms and Conditions, or Purchase Order.

Related Sections: The following Sections contain requirements that relate to this Section:
Section 02752: Asphaltic Concrete Paving.
Section 02754: Recycled Asphaltic Concrete Paving.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

References

AASHTO - M147	Materials for Aggregate and Soil-Aggregate.
AASHTO T180	Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-inch (457 mm) Drop.
ASTM C136	Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM D698	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
ASTM D1557	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
ASTM D2167	Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
ASTM D2487	Classification of Soils for Engineering Purposes.

ASTM D2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D3017	Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D4318	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

SUBMITTALS

Procedure: Submit each item in this Section and according the UNLV direction.

Comply with pertinent provisions of Sections 01330, and as follows:

Aggregate Base: The Contractor shall submit within seven (7) calendar days after receipt of the Notice to Proceed, certification from the testing firm that the aggregate base material meets the requirements of these specifications for approval by the Engineer or Owner's representatives.

Approval of the certification shall be the Contractor's authorization to order the required material. There will be no deviation from the approved certification without written approval from the Engineer or Owner's representative.

PRODUCT STANDARDS

Type II Aggregate Material – Testing and Analysis: Perform in accordance with applicable portions of Section 02208, Base Aggregate.

If tests indicate materials do not meet specified requirements, change material or material source and re-test.

Provide materials of each type from same source throughout the Work. Provide test results confirming compliance with specifications prior to use of material.

LAB TESTING

The Owner shall select and pay for the service of a testing firm to perform all required testing.

Aggregate gradation testing will be conducted by the testing firm. Two samples shall be taken from stockpile for testing and approval before the placement of aggregate begins. The testing laboratory shall determine the maximum density as specified.

During the placement of aggregate base, one sample per day shall be taken for gradation testing.

INSTALLATION GUIDELINES

The aggregate base material will be delivered to the site in a thoroughly blended condition, and shall be handled in such a manner that there will be no excessive segregation or mixing of the underlying soil or sub-base with the base material.

Stockpiling - If Stockpiling is required, Stockpile materials on-site at locations approved by Engineer or

Owner and as follows: Stockpile in sufficient quantities to meet project schedule and requirements. Separate differing materials with dividers or stockpile apart to prevent mixing. Direct surface water away from stockpile site so as to prevent erosion or deterioration of materials.

Stockpile Cleanup - Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

Subgrade Preparation - Any ruts, holes, defects, or soft yielding places which occur in the subgrade or subbase for any cause whatsoever shall be corrected and compacted to required density and stability before an aggregate base course is placed thereon. The above mentioned repairs shall be made at no additional cost to UNLV. The tolerance to the plan elevation grade shall be +0 foot and -0.1 foot.

Unless otherwise specified, the top 6 inches of subgrade shall be compacted to not less than 90 percent compaction.

Spreading Aggregates - The aggregate shall be uniformly deposited on the approved subgrade by means of the hauling vehicle with or without spreading devices. Aggregate shall be distributed over the surface to the depth specified on the Drawing or established by the Engineer or Owner.

After base course material has been deposited, it shall be thoroughly blade-mixed to full depth of the layer by alternately blading the entire layer to the center and back to the edges of the roadway or parking lot. The material shall then be spread and finished to the required cross section by means of a self-propelled pneumatic-tired motor grader.

At the option of the Contractor, the aggregate may be spread with an approved self-propelled spreader with the aggregate ready for compaction without further shaping. If this option is exercised; however, the operation shall become subject to the requirements of this Section.

Reference points will be established on one side of the roadway at intervals approved by the Engineer or Owner.

Furnish, place, maintain, remove, and dispose of all materials required to provide continuous line and grade control to the placing machine.

Watering and Mixing Aggregates - The base course material and water may be mixed at the plant in a mixer approved by the Engineer or Owner.

Water shall be added during the mixing operation by means of spray bars in the amount necessary to provide the optimum moisture content for compacting.

After mixing to the extent that the product has a uniform homogeneous appearance, the material shall be transported to the job while it contains the proper moisture content and may be placed on the roadbed or parking lot by means of an approved self-propelled aggregate spreader.

If the material has dried appreciably prior to final compacting, additional water shall be added by means of a pressurized water truck to assist in compaction and to prevent raveling.

Watering - Water may be applied prior to and during all blading and processing operations to moisten the material sufficiently to prevent segregation of the fine and coarse particles.

Water shall be applied during the compaction and maintenance stages in sufficient amounts to assist in compaction and prevent raveling.

Compaction - Compaction shall immediately follow the spreading operation. Where the required thickness is 6 inches or less, the base course may be spread and compacted in 1 layer.

However, if vibratory compaction equipment of a type approved by the Engineer or Owner is used, and the requirement for density is complied with, the compacted thickness of any 1 layer may be increased to 8 inches.

Aggregate bases placed on road approaches and connections, street intersection areas, median strip areas, shoulder areas, and at locations that are inaccessible to the spreading equipment may be spread in one or more layers by any means to obtain the specified results.

Each layer of material shall be compacted to not less than 95 percent compaction, except for under sidewalk areas, where the material shall be compacted to not less than 90 percent compaction.

A loss of density in the upper portions of the material may occur due to the elements or for other reasons. Recompaction to the specified density will be required prior to placement of any subsequent course and no additional compensation will be allowed for such recompaction.

Tolerance for Finished Surface - When a 10-foot straightedge is laid in any direction, the finished surface shall not deviate at any point more than ½ inch from the bottom thereof.

The tolerance to the plan elevation grade shall be +0 foot and -0.05 foot.

QUALITY CONTROL

Type II Aggregate Material – Testing and Analysis: Perform in accordance with applicableportions of Section 02208, Base Aggregate.

If tests indicate materials do not meet specified requirements, change material or material source and re-test.

Provide materials of each type from same source throughout the Work. Provide test results confirming compliance with specifications prior to use of material.

FIELD TESTING

Field compaction testing shall be performed by the testing firm. At least one test per 1,500 square yards of prepared aggregate base shall be performed. Test sites shall be selected at random by the testing firm.

The testing firm shall determine the base thickness at the location of each compaction test.

Any areas showing insufficient compaction or thickness shall be corrected and tested.

The Owner’s representative may require additional tests over and above the one per 1,500 square yards in or around any areas of failure.

SECTION 02208

BASE AGGREGATE

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This specification covers the quality and size of mineral materials used in base courses.

The term source shall mean any of the following:

A permanent commercial location

Contractor manufactured material either commercial or on-site

RELATED DOCUMENTS

Documents affecting work of this section include but are not necessary limited to the drawings (if applicable), UNLV written directions, UNLV Terms and Conditions, or Purchase Order.

Related Sections: The following Sections contain requirements that relate to this Section:
Section 02752: Asphaltic Concrete Paving.
Section 02754: Recycled Asphaltic Concrete Paving.
Section 02207: Aggregate Material

Related Interagency Quality Assurance Committee (IQAC) procedures.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

SUBMITTALS

Procedure - Submit each item in this Section and according the UNLV direction.

Comply with pertinent provisions of Sections 01330, and as follows:

Aggregate Base - The Contractor shall submit within seven (7) calendar days after receipt of the Notice to Proceed, certification from the testing firm that the aggregate base material meets the requirements of these specifications for approval by the Engineer or Owner’s representatives.

Approval of the certification shall be the Contractor’s authorization to order the required material. There will be no deviation from the approved certification without written approval from the Engineer or Owner’s representative.

PRODUCT STANDARDS

The mineral aggregate shall be the crushed and screened product from approved aggregate deposits. The Engineer or Owner reserves the right to prohibit the use of aggregates from any source when:
The character of the material is such, in the opinion of the Engineer or Owner, as to make improbable the furnishing of aggregates conforming to the requirements of these specifications.

The character of the material is such, in the opinion of the Engineer or Owner, that undue additional costs may be accrued by UNLV.

The mineral aggregate shall be clean, hard, durable, free from, any frozen lumps, deleterious matter, and harmful adherent coatings. Crushed Portland cement concrete and asphaltic concrete pavement will be permitted, subject to the requirements of these specifications. No material subject to regulation as hazardous wastes as defined in the Nevada Administration code 444.8565 shall be allowed.

IQAC Source Qualification - For expediting of material source and type approvals, a listing of qualified materials has been provided on the IQAC website.

Any listed material is considered qualified for use without a material testing submittal. However, this does not relieve the Contractor of project testing and the material as required in these specifications.

The IQAC posted materials indicated in Table 1 are subject to re-approval annually for continued posting on the IQAC website.

Table 1 – IQAC Materials that Require Annual Qualifications

Type II Aggregate Base

Deficiencies - If the product of a deposit is deficient in material passing the No. 16 sieve, filler from other approved deposits may be added at the crushing and screening plants. This is not to be construed as a waiver of any of the requirements contained herein.

Plastic Limits - When specified, aggregates shall conform to the applicable requirements of the following table:

Table 2 – Plastic Limits

Percentage by Weight Passing 200 Sieve	Plasticity Index Minimum
0.1 to 3.0	15
3.1 to 4.0	12
4.1 to 5.0	9
5.1 to 8.0	6
8.1 to 11.0	4
11.1 to 15.0	3

Type II Aggregate Base - This Aggregate shall conform to the following requirements

Table 3 – Type II Gradation Acceptance Limits

Sieve Sizes	Percentage by Dry Weight Passing Sieve
1-inch	100
¾ inch	90-100
No. 4	35-65
No. 16	15-40
No. 200	2-10

Table 4 – Type II Acceptance Limits

Quality Control Test	Test Method	Requirements
Sieve Analysis	AASHTO T27	Table 8
Sampling Aggregate from Calibrated Conveyor stream or belt cut[1]	AASHTO T2	-
Fractured Faces	Nev. T230	70% Minimum
Plasticity Index	AASHTO T90[2]	Table 3
Liquid Limit	AASHTO T89	35 Minimum
Resistance (R Value) or Resilient Modulus	ASTM D2844 AASHTO T307	78 Minimum for road base 35,000 psi minimum for road base
Percentage of Wear (500 Rev.)	AASHTO T96	45% Maximum
Total Available Water Soluble Sulfates[3]	AWWA 3500-NaD AWWA 4550 E	Less than 0.3% by dry weight of soil

QUALITY CONTROL

There are 2 testing aspects to Source material acceptance:

Testing by the source for annual posting on the IQAC website of qualified materials

Contractor project quality control Source testing for non –qualified materials.

The acceptance of the Source material shall be at the production plant while the acceptance of the Contractor-placed materials is at the project site.

Any laboratory submitting to an agency shall be R-18 AASHTO accredited in the appropriate test method in accordance with Table 5, "Source Quality Control Testing Requirements," where applicable and testing reviewed and stamped by a Nevada professional engineer who has responsible charge of the work. The use of a professional engineer by the Source could be the Source staff engineer or third party, but the professional engineer must have responsible charge of the testing and/or inspection.

Sampling from a stockpile permitted only after approval of the Engineer; the conveyor device shall be calibrated every 3 months and record attached to sample document.

Test specimens shall be prepared following the dry preparation procedure AASHTO T87.

Required only for placement around waterline pipe.

IQAC Annual Material Prequalification - Each individual location or "pit" shall be referred to as a "Source." The responsibility for testing and inspection is the material Source. Material shall be tested, inspected, and certified in accordance with Table 5, "Source Quality Control Testing Requirements." The Source shall submit to the IQAC agency engineer assigned for that Source. The reviewing agency is listed on the IQAC website page next to the Source material.

Test data shall be included with the certifying document.

The maximum qualification period is 1 year, or 6 months for aggregate blended with crushed concrete. The entire qualification process shall be completed, in accordance with the sections above, prior to the first day of April, or the aggregates blended with crushed concrete, the first day of April and the first day of October of each year. This includes, but is not limited to, submittal, agency review, all required retesting, and qualification from the IQAC member.

Non-Prequalified Materials - If the material is not posted on the IQAC web page, the Source may elect to submit non-prequalified material to the Engineer or Owner for approval prior to use that complies with the above noted specification and shall have been tested within 60 days of the intended use.

Submittal - All tests specified in this section shall be performed.
The report(s) shall include any graphical representation of plotted data such as the R-value or the Proctor value(s) along with the pit name and location.

The most current ASTM, AASHTO, NDOT, and AWWA methods shall be used when performing the tests. All samples shall be "cut" from the "belt". When circumstances do not allow for sampling during production, the Source shall coordinate with the Engineer or Owner to identify an alternative plan for sampling.

IQAC Annual Submitting - For the purposes of IQAC submittal, the Engineer is the IQAC reviewing agency as noted on the IQAC web page.

For the annual submittal by the supplier, the material to be approved for use as aggregate shall be obtained and "split" by an AASHTO accredited laboratory with the Engineer or Owner present at the time the sample is obtained with the sample large enough for a full suite of testing for the Source and Engineer or Owner.

The Engineer or Owner shall be notified a minimum of 48 hours prior to obtaining the sample.
If the Engineer or Owner is not present during the sampling of the material, the results for that sample will not be accepted.

Sampling shall be performed during normal working hours for the Engineer or Owner.

If the source laboratory results are in compliance with the above noted specifications, Source shall submit the test report to the Engineer or Owner within 21 days of sampling requesting the review and approval of the materials for the proposed use of the material.

Notification by the Source of samples not in compliance with the above noted specifications is requested but not required. Samples without notification or a qualification submittal within the 21-day period will be assumed by the IQAC to be outside the above noted specifications.

The agency Engineer or Owner for a particular pit may accommodate minor adjustments for "tuning" of an operation. This courtesy shall not be extended during the qualification process.

Non-prequalified materials (materials not posted on the IQAC list) - The material to be approved for use as aggregate shall be obtained and "split" by an AASHTO accredited laboratory with the UNLV Engineer or Owner's representative present at the time the sample is obtained with the sample large enough for a full suite of testing for the Source and Engineer.

The UNLV Engineer or Owner's representative shall be notified a minimum of 48 hours prior to obtaining the sample.

If the UNLV Engineer or Owner's is not present during the sampling of the material, the results for that sample will not be accepted.

Sampling shall be performed during normal working hours for the UNLV Engineer or Owner.

If the Source laboratory results are in compliance with the above noted specifications, the Source shall submit the test report to the UNLV Engineer or Owner's representative within 21 days of sampling with a letter requesting the review and approval of the materials report for the proposed use of the material.

Notification by the Source of samples not in compliance with the above noted specifications is requested but not required.

Samples without notification or a qualification submittal within the 21-day period will be assumed by the UNLV Engineer or Owner's representative to be outside the above noted specifications.

This qualification is for one project only.

Report Format - The report shall be prepared and stamped by, or under the direction of, a professional engineer registered in the State of Nevada. The report shall be on the standard IQAC4 form and shall include the pit name and location. The report shall include the following:

Recommendations by the Source Professional Engineer.

The testing results in accordance with the appropriate Table 5, "Source Quality Control Testing Requirements," test methods and reporting requirements, along with any graphs and charts.
When "no expectations" are taken, a conditional posting on the web site will be provided by the IQAC within 10 days of the receipt of the submittal.

Discrepancies between test results will be reviewed on a case-by-case basis. The UNLV Engineer will notify the aggregate producer of substantial test variations within 10 days of receipt of the qualification submittal.

Sampling and Testing - When the Contractor/Material Source or Engineer or UNLV representative acquires aggregate samples at an aggregate production plant, the plant shall provide a calibrated mechanical means for obtaining samples.

If a mechanical means is not provided, a belt cut from a stopped conveyor will be required.

Any mechanical sampling device shall be approved by the Engineer or UNLV representative prior to starting the respective phase of the project, or shall have been approved as part of a prior plant inspection by the Engineer or UNLV representative or the Engineer's representative.
The sampling device shall be so constructed to provide for simultaneous "cutting" of the entire section of material being discharged or conveyed, and so constructed that small representative samples may be taken frequently and these samples combined to form the complete sample.

The form is on the IQAC website, or use a UNLV approved form.

The reference method for the mechanical procedure shall be a "belt cut" sample taken from a stopped conveyor belt.

Samples of the finished product of the plant shall be obtained prior to or as the material leaves the conveyor belt for the bin or stockpile.

Test results run from samples taken will be furnished to the Engineer by the Contractor or the Contractor's representative. The results of such tests shall not be the basis for final acceptance of the material.

Sampling for final acceptance of materials will be as required in the appropriate UNLV Standard Specification sections and in general shall comply with the AASHTO requirements, where applicable, and with any exception to the method(s) listed on the IQAC website.

Table 5 – Source Quality Control Testing Requirements5

Spec Section	Description	Item	Reference Specification And/or Test Procedure	Frequency
02207	Type II Aggregate	Sampling from Calibrated conveyor Stream or belt cut	AASHTO T2	1/day at plant
02207	Type II	Total Available Water Soluble Sulfates*6	AWWA 3500-NaD AWWA 4550 E	1/month at plant
02207	Type II Aggregate	Plasticity Index Liquid Limit Resistance (R Value) Or Resilient Modulus	AASHTO T90 *7 AASHTO T89 ASTM D2844 ASSHTO T307	1/day at plant 1/day at plant Annually for IQAC Source Qualification Or for Project Annually for IQAC Source Qualification Or for Project

SECTION 02231

TREE PROTECTION AND TRIMMING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and includes the protection and possible trimming of existing trees during construction.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Drawings shall clearly identify which existing trees and other plant materials are to remain.

Coordinate with the Owner's Arborist on which plants shall remain.

Locate and clearly flag trees and vegetation to remain or to be relocated.

Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

Provide method for providing temporary watering for all existing trees and plants scheduled to remain.

Do not excavate within tree protection zones, unless otherwise indicated.

Do not prune any plant material without authorization from Owner's representative.

Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

SECTION 02510

WATER DISTRIBUTION

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager. Also refer to "Uniform Design and Construction Standards" (UDACS), latest edition.

SUMMARY

This section contains the design criteria for exterior water distribution systems. Section 15140: Domestic Water Piping contains the design criteria for internal water systems.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Place all water distribution piping a minimum of 10' horizontally and/or 18" vertically from sanitary sewer piping. Follow UDACS Section 2.19 Separation Requirements.

Bury water distribution piping at least 4' below grade.

All work performed within the Las Vegas Valley Water District (LVVWD) and Clark County right-of-way must conform to regional water authority design standards.

SUBMITTALS

Submit the following design and construction documents to UNLV.

Design Documents - Submit plan views of all design drawings. Profile views shall be provided for all crossings/ conflicts.

Before starting construction, submit permits for exterior water main improvements to the regional water authority.

Construction Documents - Manufacturer specifications must conform to the standards in this section and must also be on the LVVWD approved materials list.

Before starting construction, forward manufacturer installation procedures and disinfection certificates to UNLV.

Provide a list of materials and the names and addresses of the organizations that can readily stock repair parts.

PRODUCT STANDARDS

All water distribution pipe joints must conform to ANSI A21.10 and ANSI

A21.11 standards for push-on-joint type, ductile iron pipe.

All water distribution pipes for underground use must conform to ANSI A-21.51 and AWWA Class 52 standards with a working pressure of not less than 150 psi, unless otherwise specified. Use cement mortar lining of standard thickness that conforms to ANSI A-21.4 or AWWA C205 standards. PVC pipe shall meet CL150, C900 AWWA criteria.

Unless otherwise specified, all fittings must withstand a minimum pressure of l50psi.

Fire hydrants must be UL listed and have:

A main valve opening of 5.5"

Two, 2.5" hose nozzles and one 4.5" pumper nozzle

Standard threads

A left-hand opening nut

A working pressure of 175 psi

ACCESSORIES OR SPECIAL FEATURES

Install all fire hydrants with a gate valve on the hydrant service main.

INSTALLATION GUIDELINES

Mechanically tie all bends, tees, crosses, hydrants, and valves to the straight runs of water distribution pipe, using approved retaining glands and/or threaded rods and nuts.

UNLV will consider the use of thrust blocks in lieu of mechanical restraints. Review this design consideration with UNLV before completing the construction document.

Provide a uniform bedding for the pipe by placing a 4" of sand or fine gravel in the trench and tamping it. Using a material similar to the bedding, backfill the entire trench width evenly in 6" lifts to 6" above the top of the pipe. Compact the lifts to at least a 95% Standard Proctor density, meeting ASTM DI556 standards at optimum moisture (or as recommended by the soils engineer). Backfill the remaining trench in lifts not to exceed 12" up to the sub-grade height for the surface condition encountered. Compact the lifts to a 95% Standard Proctor density, meeting ASTM D1556 standards at optimum moisture (or as recommended by the soils engineer). Backfilling and compacting above the sub-grade must be determined by the soils engineer or by the recommended paving design for the project. In LVVWD Easements and County right-of-ways, bedding shall be in conformance with municipal standards.

In conjunction with UNLV, prepare a shutdown procedure document, before starting construction, that outlines scheduling and notification requirements.

Contact the regional water authority when working within the LVVWD right-of-way. A permit is required when connecting to the regional water authority.

QUALITY CONTROL

Work on exterior water distribution systems must conform to the following quality control standards.

Testing Laboratory - UNLV will retain the services of a qualified, independent testing laboratory to compaction tests, as directed, during construction.

Testing Methodology and Extent - After the trench is partially backfilled, hydrostatically test water distribution piping to 200 psi in accordance with AWWA C-600. Open and close all valves several times during the test. Any drop in pressure requires a visual inspection of all joints.

CLEANING AND ADJUSTING

Disinfect all tested water distribution systems in accordance with AWWA C-601.

Dispose of all wastewater in a sanitary sewer, not in a storm sewer.

START-UP AND TRAINING

The contractor must walk the site with UNLV personnel to verify the location and operation of all valves.

SECTION 02530

SANITARY SEWERAGE SYSTEMS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager. Also refer to “Uniform Design and Construction Standards” (UDACS), latest edition.

SUMMARY

This section contains the design criteria for exterior sanitary sewer systems. Section 15150: Sanitary or Laboratory Waste and Vent Piping contains the design criteria for internal sanitary sewer system piping.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Separate all combined sanitary and storm sewer systems as part of any new building project. Sanitary and storm sewer systems must be placed at least five feet from building walls. Sanitary and storm sewer system pipes must be separated by at least ten feet.

All work, including connection to public sewer mains, must meet Clark County Water Reclamation District (CCWRD) sanitary district requirements.

The minimum slope on all service pipes must be 0.4% for 8”. 4” and 6” pipes must meet minimum building code requirements.

All mains that collect more than one service line must be at least 8" in diameter.

All service lines from buildings must be at least 4" in diameter.

Place at least two, but not more than five, 2" concrete adjusting rings on all sanitary sewer system manholes, before placing the manhole castings.

Stamp the words "Sanitary Sewer" on all manhole casting covers.

Install manholes wherever sanitary sewer pipe must bend. Clean-outs are not allowed for exterior sanitary sewerage.

Place sanitary sewer piping at least 10' horizontally and/or 18" vertically from all water distribution lines. Follow UDACS Section 2.19 Requirements.

SUBMITTALS

Submit the following design and construction documents to UNLV:

Design Documents - Plan and profile views of all design drawings. Pipe sizing calculations shall show minimum 2 ft/sec. velocities for self-cleaning.

Construction Documents - Before starting construction, submit: A list of materials, Manufacturer specifications and installation procedures

PRODUCT STANDARDS

Manufacturers - Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to the Campbell Foundry Co. (manhole castings and covers).

Materials - All exterior sanitary sewer pipe must be polyvinyl chloride (PVC) SDR 35, with gasket watertight joints, that meets the requirements of ASTM D3034.

All manholes must be pre-cast, reinforced concrete with aluminum- or plastic-covered steel rungs.

Manhole castings must be cast iron that meets ASTM A48, Class 25 B requirements for frames and 30 B requirements for covers.

Materials shall be on the Clark County Water Reclamation approved materials list.

INSTALLATION GUIDELINES

Where possible, provide a uniform pipe bedding of suitable on-site material. If suitable material is not available, backfill the trench with sand. Using a material similar to the bedding, backfill the entire trench width evenly in 6" lifts to 6" above the top of the pipe. Compact the lifts to at least a 95% Standard Proctor density, meeting ASTM Dl 556 standards at optimum moisture (or as recommended by the soils engineer). Backfill the remaining trench in lifts not to exceed 12" up to the sub-grade height for the surface condition encountered. Compact the lifts to a 95% Standard Proctor density, meeting ASTM Dl 556 standards at optimum moisture (or as recommended by the soils engineer). Backfilling and compacting above the sub-grade must be determined by the soils engineer or by the recommended paving design for the project. Construction within CCRWD easements or a public right-of-way shall conform to entity requirements.

In conjunction with UNLV, prepare a shutdown procedure document, before starting construction, that outlines scheduling and notification requirements.

When connecting to the public sewer main, contact the CCWRD for approval. A permit is required from the CCWRD to connect to their public sewer main and for
all work.

QUALITY CONTROL

Work on exterior sanitary sewer systems must conform to the following quality control standards.

Testing Laboratory - UNLV will retain the services of a qualified, independent testing laboratory to perform soil compaction tests, as directed, during construction.

Testing Methodology and Extent - Mandrel and ex filtration tests must be performed on all sanitary sewer system piping before acceptance by UNLV. Plugging the lower end of the pipe at a manhole, filling the upstream manhole to 4' with water, and checking for leaks constitutes an exfiltration test. Leakage cannot exceed 0.15 gal/inch per 100' of pipe for one hour.

SECTION 02550

SITE UTILITIES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for site utilities.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

High Voltage Conduit - All underground service conduits serving systems over 600 Volts shall be encased in red colored concrete with the encasement extending a minimum of 3 inches completely around the conduit.

A spare conduit shall be provided wherever a conduit containing a circuit over 600 Volts is routed under a hard surface such as a concrete slab, concrete sidewalks, block planters, asphalt parking lot, etc.

Manholes - Manholes and pull boxes used for communication circuits shall have their covers painted green. Manholes and pull boxes used for power circuits shall have their covers painted red. They shall be prepared and painted properly for the material involved.

Routes and Trenching - Utility installation shall be routed with existing trees considered. Roots under 2” in diameter must be cut cleanly and not left crushed or torn. Utility installation in areas where roots exceed 2” in diameter should be accomplished by tunneling under the root system as opposed to cutting. Protect as large a root area as possible.

The Contractor to mark utilities prior to excavation. In the event that information is not available for marking, Contractor shall use appropriate means and methods (IE: hydrovac, etc.)

SECTION 02551

HYDRONIC DISTRIBUTION

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and includes information on hydronic distribution piping

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

This includes the design of piping to be used for closed-loop hydronic piping systems and ground-source heat exchange systems.

System shall be designed by a registered engineer.

Consultants shall review geo-technical reports for project site in regards to soil conditions, recommendations for buried piping, etc.
Piping shall be polyethylene plastic – ASTM D 2239, and/or ASTM D 3035. Provide minimum pressure rating of at least 160 psig.

Provide fittings per manufacturer's recommendations to withstand design pressures.

Grout (Sealing Clay): Mixture of high-solids bentonite clay and potable water. Do not use bentonite 'gel.'

Coordinate with Earthwork Section regarding excavating, trenching and backfilling.

Clean PE pipe and fittings for loop. Minimize number of joints.

Purge, flush and pressure test piping before backfilling trenches. Owner's representative shall be present for all testing.

Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for minimum of 2 hours.

Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0-psig. Slowly increase again to test pressure and hold for 1 more hour. Repair leaks and retest until no leaks exist.

Prepare reports of testing activities.

Identification: Install continuous underground detectable warning tape for underground piping. Locate below finished grade, directly over piping. Refer to Earthworks Section for underground warning tapes – and specific designation type.

SECTION 02580

PAVEMENT MARKINGS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager. Also refer to “Uniform Design and Construction Standards” (UDACS), latest edition.

SUMMARY

This Section provides for site markings and furniture as shown on the drawings and as specified herein for a complete and proper installation. Principal work in this Section includes: Pavement markings.

RELATED DOCUMENTS

Documents affecting work of this Section include but are not necessarily limited to the Drawings, or written instructions from the Engineer or Owner.

SUBMITTALS

Procedure; Submit each item in this Section in accordance with the referenced Sections. Comply with pertinent provisions of Section 01330.

PRODUCT STANDARDS

All Materials shall comply with specifications commonly used in the Clark County area.

INSTALLATION GUIDELINES

Inspection - Verify conditions and measurements affecting the work of this Section at site. Make sure that detrimental conditions are corrected before proceeding with installation.

Preparation - Remove dust, debris, curing and sealing compounds, and other foreign substances detrimental to epoxy adhesive and paint bond. Use a commercial degreasing solution to remove grease and oil.

Take field measurements and make layouts required.

Pavement Markings - Clean surfaces to be painted, and mix and apply paint in compliance with the paint manufacturer's printed instructions.

Paint pavement lines and legends in compliance with the layout shown on the Drawings, or written instructions from the Engineer or Owner. The work shall be straight or curved as indicated, of uniform color and texture with edges parallel, clean, sharply defined and accurate.

Thickness of cured paint film shall be per specification in common use in the Clark County area.

Erect temporary barriers and signs, and leave them in place until the paint has thoroughly dried.

SECTION 02584

UNDERGROUND DUCTS AND UTILITY STRUCTURES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and includes information on underground ducts, duct banks and utility structures.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Provide for ducts in direct-buried or concrete-encased duct banks. Handholes and Manholes shall be provide per applicable code and as follows:

Components

Handholes: Precast, reinforced concrete

Extensions to Grade – Precast collars and rings
Waterproofing
Sump Frame and Grate

Manholes: Precast concrete with iron frames and covers

Extensions to Grade – Precast collars and rings
Waterproofing
Sump Frame and Grate

Applications

Underground Ducts for Electrical Cables Higher Than 600 V: Type EPC-40-PVC, concrete encased.

Underground Ducts for Electrical Feeders: Type EB-20-PVC, concrete encased.

Underground Ducts for Electrical Branch Circuits: Type DB-60-PVC, direct buried.

Underground Ducts for Telephone Utility Service: Type EPC-40-PVC, direct buried.

Underground Ducts for Communication Circuits: Type EPC-40-PVC, direct buried.

Install Warning tape above concrete-encased duct banks.

Concrete warning planks above direct-buried duct banks.

Coordination

Coordinate layout and installation of ducts, manholes, and handholes with final arrangement of other utilities and site grading, as determined in the field.

Coordinate elevations of ducts and duct-bank entrances into manholes and handholes with final profiles of conduits as determined by coordination with other utilities and underground obstructions. Revise locations and elevations from those indicated as required to suit field conditions and to ensure duct runs drain to manholes and handholes, and as approved by Architect.

INSTALLATION GUIDELINES

Excavation and Backfill - Comply with Division 2 Section "Earthwork" but do not use heavy-duty, hydraulic-operated, compaction equipment.

Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

Restore all areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 2 Section "Landscaping."

Restore disturbed pavement. Refer to Division 1 Section "Cutting and Patching."

Conduit and Duct Installation

Installation to conform to applicable local codes.

Testing of all underground ducts to be witnessed by UNLV Inspector.

SECTION 02630

STORM DRAINAGE

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains the design criteria for exterior storm sewer systems. Section 15160: Storm Drainage Piping contains the design criteria for internal storm sewer piping.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Separate all combined sanitary and storm sewer systems as part of any new building project. Sanitary and storm sewer systems must be placed at least five feet from building walls. Sanitary and storm sewer system pipes must be separated by at least ten feet. Separation may be reduced to six feet when “water quality” type pipe is used for the Sanitary system.

All work within the Clark County right-of-way, including connection to public storm sewer mains, must meet entity requirements.

The minimum slope on all service pipes must be 0.5%.

All mains must be at least 12" in diameter.

Place at least two, but not more than five, 2" concrete adjusting rings on all storm manholes, before placing the manhole casting.

Stamp the words "Storm Sewer" on all manhole casting covers.

Install manholes wherever storm sewer pipe must bend. Clean-outs are not allowed for exterior storm sewerage.

All storm water management must meet Clark County guidelines.

All storm water piping systems must conform to the 10-year, 1 -hour design.

Provide erosion control measures for construction activities that meet Clark County guidelines.

During design, always consider removing, to the surface, the direct flow of runoff from pipes and discharge to reduce the time of concentration runoff. This design is consistent with EPA Phase II storm water rules, minimizes downstream impacts, and improves water quality treatment.

SUBMITTALS

Submit the following design and construction documents.

Design Development Documents - Submit plan and profile views of all design drawings to UNLV Project Manager.

Submit storm water management calculations to Clark County for review and approval, as required.

Construction Documents - The project specifications shall direct the contractor to submit a list of materials, manufacturer specifications, and installation procedures to UNLV before starting construction.

PRODUCT STANDARDS

Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the Campbell Foundry Co. (catch basin and manhole castings and covers).

All exterior storm sewer pipe must be - Polyvinyl chloride (PVC) SDR 35, with gasket watertight joints, that meets the requirements of ASTM D3034

Class 5, reinforced concrete pipe (RCP), with gasket joints, that meets the requirements of ASTM C76

Heavy duty polyethylene (HDPE) pipe that meets AASHTO Specification M294, Type S and the requirements of ASTM D3350

All manholes must be pre-cast, reinforced concrete, with aluminum- or plastic-covered steel rungs.

Manhole and catch basin castings must be cast iron that meets ASTM A48, Class 25 B requirements for frames and 30 B requirements for covers.

Special Requirements - All force main pumps must be duplex pumps.

INSTALLATION GUIDELINES

Where possible, provide a uniform pipe bedding of suitable on-site material. If suitable material is not available, backfill the trench with sand. Using a material similar to the bedding, backfill the entire trench width evenly in 6" lifts to 6" above the top of the pipe. Compact the lifts to at least a 95% Standard Proctor density, meeting ASTM D1556 standards at optimum moisture (or as recommended by the soils engineer). Backfill the remaining trench in lifts not to exceed 12" up to the sub-grade height for the surface condition encountered. Compact the lifts to a 95% Standard Proctor density, meeting ASTM D1556 standards at optimum moisture (or as recommended by the soils engineer). Backfilling and compacting above the sub-grade must be determined by the soils engineer or by the recommended paving design for the project.

In conjunction with UNLV, prepare a shutdown procedure document, before starting construction, that outlines scheduling and notification requirements.

When connecting to the public storm sewer main, contact Clark County for approval. A permit is required from the city to connect to their public sewer main and for all work within the Clark County right-of-way.

QUALITY CONTROL

Work on exterior storm sewer systems must conform to the following quality control standards.

Testing Laboratory - UNLV will retain the services of a qualified, independent testing laboratory to perform soil compaction tests, as directed, during construction.

Testing Methodology and Extent - A mandrel test must be performed on all non-concrete storm sewer piping before acceptance by UNLV.

CLEANING AND ADJUSTING

With the participation of UNLV personnel, lamp all piping before acceptance by UNLV.

SECTION 02754

RECYCLED ASPHALTIC CONCRETE PAVING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section provides for processing of recycled asphaltic concrete paving in a central plant and relaying the reprocessed asphaltic concrete mixture on a prepared surface in accordance with the drawings, or as directed in writing by the Engineer or Owner.

The work includes installing recycled asphaltic concrete paving areas and patching and repairs to existing asphaltic concrete area. The recycled asphaltic concrete and aggregate base thickness will be shown on the drawings, or as detailed in writing by UNLV request of bids, or purchase order. Generally, on the UNLV campus, parking areas receive 2.5 inches of asphaltic concrete over 4 inches of Type II Aggregate Base. Parking lot drive aisles generally receive 3 inches of asphaltic concrete over 4 inches of Type II Aggregate Base. Heavier traffic areas such as the Thomas and Mack entry drive off Swenson may require thicker asphalt and base sections. These areas should have a geotechnical investigation performed and a report prepared with paving recommendations.

RELATED DOCUMENTS

Documents affecting work off this Section include but are not necessarily limited to the Drawings (if applicable), UNLV written directions, UNLV Terms and Conditions, or Purchase Order.

Related Sections: The following Sections contain requirements that relate to this Section:
Section 02207: Aggregate Materials
Section 02580: Pavement Markings
Section 02752: Asphaltic Concrete Paving
Section 02758: Bituminous Materials

References

ASTM D946	Penetration Graded Asphalt Cement for Use in Pavement Construction.
TAI (The Asphalt Institute)	MS-2 Mix Design Methods for Asphalt Concrete and Other Hot Mix Types
TAI (The Asphalt Institute)	MS-3 Asphalt Plant Manual
TAI (The Asphalt Institute)	MS-8 Asphalt Paving Manual
TAI (The Asphalt Institute)	MS-19 Basic Asphalt Emulsion Manual
TAI (The Asphalt Institute)	Manual MS-4 The Asphalt Handbook

TAI (The Asphalt Institute)	Manual MS-13 Asphalt Surface Treatments and Asphalt Penetration Macadam
TAI (The Asphalt Institute)	MS-22 Construction of Hot Mix Asphalt Pavements

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Provide recycled hot-mix asphalt pavement according to the materials, workmanship, and other applicable requirements as specified herein.

SUBMITTALS

Procedure - Submit each item in this Section according to these specifications and UNLV contract conditions.

Comply with pertinent provisions of Section 01330.

Product Data and Shop Drawings - Within 5 calendar days after the Contractor has received the Owner's Notice to Proceed, submit:

Product data: For each product specified. Include technical data and tested physical and performance properties.

Shop Drawings - Indicate pavement markings, lane separations, and defined parking spaces. Indicate dedicated handicapped spaces with international graphics symbol.

Job-Mix Design - Certification that the proposed job-mix design is in general use in the Las Vegas Valley for each job mix proposed for this Work. Prepare mix design in accordance with Section 02755, subsection 2.1, "Composition of Mixtures."

Qualification Data Include lists of completed projects with project names and addresses, names and addresses of engineer, architects and owner, and other information specified.

Material Test Reports - Indicate and interpret test results for compliance of materials with requirements indicated.

Material Certificates - Certificates signed by manufacturers certifying that each material complies with requirements.

Delivery and Storage – Deliver pavement-marking materials to project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

Store pavement-marking materials in a clean, dry, protected location and within temperature range required by manufacturer. Protect stored materials from direct sunlight.

Environmental Requirements – Do not place asphalt when ambient air, base surface or asphaltic mixture temperature does not conform to the requirements below or when surface is wet or frozen.

Prime and Tack Coats – Minimum surface temperature of 60 deg F

Slurry Coat – Comply with weather limitations of ASTM D 3910

Asphalt Base Course – Minimum surface temperature of 40 deg F and rising at time of placement.

Asphalt Surface Coarse – Minimum surface temperature of 60 deg F at time of placement.

Pavement Marking Paint – Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water based materials, and not exceeding 95 deg F.

Testing Agency – Contractor to use a testing agency qualified according to ASTM D3666 for testing as indicated herein, and as documented according to ASTM E 548.

PRODUCT STANDARDS

General – Use materials, gradations, and job mix formulas and that have performed satisfactorily in previous installations and in general use in the Las Vegas area.

Reclaimed aggregate shall be the product of crushed, milled, or planed bituminous pavement.

Coarse Aggregate ASTM D 692, sound, angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.

Fine Aggregate ASTM D1073, sharp edge natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

Mineral Filler – ASTM D 242, rock or slag dust, hydraulic cement, or other inert material.

Asphalt Binder – As manufactured by Paramount Petroleum Corporation, AC-30 or approved equal.

Asphalt Cement – ASTM D 3381 for viscosity-graded materials, and ASTM D 946 for penetration graded material.

Tack Coat – ASTM D 977 emulsified asphalt, or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application, applied to an existing concrete or bituminous surface.

Prime Coat – ASTM D 2027, MC-70 liquid asphalt applied to an aggregate base.

Seal Coat – SS-1h or CCS-1h, emulsified asphalt.

Water – Potable.

Recycling Agent – The recycling agent shall conform to the requirements of the following table. The grade shall be determined by the job mix formula.

SPECIFICATIONS FOR HOT-MIX RECYCLING AGENT

		RA-5		RA-25		RA-75		RA-250		RA-500	
TEST	**ASTM Test Method**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**
Viscosity @ (140°), cSt	D2170	200	800	1,000	4,000	5,000	10,000	15,000	35,000	40,000	60,000
Flash Point COC,	D92	400	-	425	-	450	-	450	-	450	-

°F											
Saturates, wt. %	D2007	-	30	-	30	-	30	-	30	-	30
Viscosity Ratio[3]	-	-	3	-	3	-	3	-	3	-	3
RTFC Oven Weight Change +/-%	D2872[2]	-	4	-	3	-	2	-	2	-	2
Specific Gravity	D70 or D1298	Report		Report		Report		Report		Report	

Auxiliary Materials

Herbicide - Commercial chemical for weed control, registered by Environmental Protection Agency (EPA). Provide granular, liquid, or wetable powder form.

Sand - ASTM D 1073, Grade Nos. 2 or 3.

Wheel Stops - Precast, air entrained concrete, 2500 psi minimum 28 day compressive strength, 4-1/2" high, 9 "wide, 72" long. Provide chamfered corners and drainage slots on underside and hole for anchoring.

The final acceptance of recycling agents meeting this specification is subject to the compliance of the reconstituted asphalt blends with current asphalt specifications.

The use of ASTM D1754 has not been studied in the context of this specification; however, it may be applicable. In cases of dispute, the reference method shall be ASTM D2872.

$$\text{Viscosity Ratio} = \frac{\text{RTFC Viscosity at 140°F cSt}}{\text{Original Viscosity at 140°F cSt}}$$

Asphalt Paving Mix

Hot-Mix Asphalt: Dense, recycled hot-laid, hot-mix asphalt plant mixes in general use in the Las Vegas Valley, and complying with the following requirements:

Provide mixes with history of satisfactory performance

Base Coarse – as specified in Section 02207, Aggregate Material

Surface Coarse – 2.5 inches for parking stalls, 3 inches for parking lot drive aisles. Other high volume traffic areas require a geotechnical investigation and report with recommended asphalt thickness.

The job mix formula shall indicate the recommended grade and amount of recycling agent and/or additional bituminous material to be used in the mix. This shall be determined by recovering the asphalt cement from representative samples of the pavement to be recycled and testing the properties of the asphalt cement after adding various amounts of the recycling agent and/or additional bituminous material. The test report shall show the curves for the following properties of the recycled asphalt cement after adding various amounts of the recycling agent and/or bituminous material;

Penetration at 77 degrees F (before and after RTFC test)

Absolute Viscosity at 140 degrees F (before and after RTFC test)

The grade and amount of recycling agent and/or additional bituminous material to be used will be that which will produce a paving grade asphaltic cement conforming to Section 02758, “Bituminous Materials”. The combined bituminous material shall meet all the requirements of an AC-20 or AC-10 grade. All properties specified for a paving grade asphalt cement shall be tested on the combined bituminous material, and the results shall be submitted with the proposed job-mix formula.

Mixture Composition

The recycled asphaltic concrete pavement plant-mix shall be composed of mixture of reclaimed asphaltic concrete pavements, additional virgin aggregate, mineral filler, if required, recycling agent, and/or additional bituminous material.

The aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resulting mixture meets the job-mix formula gradation requirements.

The reclaimed asphaltic concrete pavement used in the mix shall not exceed 15 percent.

More than 15 percent of the reclaimed asphaltic concrete pavement may be used in a the job-mix if the Engineer or Owner determines that the resultant mix satisfies the mix design requirements.

If there is a proposed change in the source of materials or reclaimed asphaltic concrete percentage, a new job-mix formula shall be established.

Bituminous Mixing Plant

If a batch plant is used, the plant shall be modified so that virgin aggregate can be superheated to a temperature required to produce a resultant mix temperature as specified in Section 02755,”Plantmix Asphaltic Concrete Pavements-General”, Subsection 2.1, “Mixture Composition” after adding the ambient temperature reclaimed bituminous pavement aggregate. Reclaimed aggregate shall be fed into the aggregate weigh hopper in a manner to ensure uniform proportioning.

If a drier drum plan is used, the plant shall be modified so that either the virgin aggregate can be super heated to a temperature required to produce the required resultant mix temperature, or the combination of reclaimed bituminous pavement aggregate and virgin aggregate can be heated to a temperature needed for the resultant mix temperature as specified in Section 02755, Subsection 2.1, “Mixture Composition”. The reclaimed aggregate shall be introduced into the plant is such a manner to ensure uniform proportioning and to protect the material from direct contact with the burner flame.

Aggregate Preparation

Virgin aggregates shall be prepared as specified in Section 02755 Aggregate Preparation.

Reclaimed asphaltic concrete pavement aggregates shall be prepared so that 100 percent will pass the 1-1/2 inch sieve. The moisture content of the reclaimed bituminous pavement aggregate at the time of introduction into the mixer shall not exceed 3 percent as determined by ASTM D 2216.

The reclaimed bituminous pavement aggregate stockpile area shall be graded and compacted so a firm level base can be maintained at all times. Layer placing or alternate approved methods shall be used to prevent coning or segregation of component sizes. The stockpile will be limited to 10 feet in height and no equipment of any type will be allowed on top of the stockpile. Maintain the stockpile in a loose and un-compacted state. To prevent premature consolidation, reclaimed bituminous pavement aggregate shall not be stored in confined metal bins or hoppers unless slated for immediate processing.

Prior to feeding the reclaimed bituminous pavement aggregate into the mixing plant, the material shall first pass through a grizzly with bars spaced 2 inches apart.

INSTALLATION GUIDELINES

Verify that compacted sub-grade is dry and ready to support paving and imposed loads.

Verify gradients and elevations of base are correct.

Proof-roll sub-base using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

Notify Engineer or Owner of any unsatisfactory condition. Do not begin paving installation until these conditions have been satisfactorily corrected.

<u>Cold Milling</u>

Clean existing paving surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement, including hot-mix asphalt and, as necessary, unbound-aggregate base course, by cold milling to grades and cross sections indicated.

Repair or replace curbs, manholes, and other construction damaged during cold milling.

<u>Saw Cutting and Patching</u>

The outline of the asphaltic concrete to be removed shall be cut in clean, straight lines with a power-driven saw to a depth equal to the depth of the existing asphaltic concrete before removing the surfacing. Surfacing and base shall be removed without damage to the pavement that is to remain in place. Damage to the pavement that is to remain in place shall be repaired to a condition satisfactory to the Engineer, or the damaged pavement shall be removed and replaced with new asphaltic concrete if ordered by the Engineer or Owner. Repairing or removing and replacing pavement damaged outside the limits of pavement to be replaced shall be at the Contractor's expense and will not be measured nor paid for by the Owner.

<u>Surface Preparation</u>

Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared sub-grade is ready to receive paving.

Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

Herbicide Treatment: Apply herbicide according to manufacturers recommended rates and written application instructions. Apply to dry, prepared sub-grade or surface of compacted-aggregate base before applying paving materials.

<u>Base Course</u>

Conforms to applicable portions of Section 02207 Aggregate Material

Preparation Primer

Apply primer uniformly over surface of compacted aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 24 hours minimum.

Apply primer on aggregate and to contact surfaces of curbs, gutters and valley gutters.

Use clean sand to blot excess primer.

Apply uniformly over surface of compacted-aggregate base. Apply enough material to penetrate an seal, but not flood, surface. Allow prime coat to cure for 24 hours minimum.

If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

Protect primed substrate from damage until ready to receive paving.

Preparation Tack Coat

Apply tack coat uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq yd. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving. Avoid smearing or staining adjoining surfaces, appurtenances, and surrounding. Remove spillages and clean affected surfaces.

Apply tack coat to contact surfaces of curbs, gutters, and existing pavement.

Coat surfaces of manhole frames with oil to prevent bonding with asphalt pavement. Do not tack coat these surfaces.

Placing Asphalt Pavement – Single Course

Install work in accordance with these specifications

Machine place hot-mix asphalt mix on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment and in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.

Place asphalt within twenty-four (24) hours of applying primer or tack coat.

Place hot-mix asphalt surface course in single-lift

Spread mix at a minimum temperature of 250 deg F

Begin applying mix along centerline of crown for crowed sections and on high side of one-way slopes, unless noted otherwise.

Install manhole frames and valve boxes in correct position and elevation.

Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

Perform rolling with consecutive passes not less than 10 feet wide, except where infill edge strips of a lesser width are required, to achieve even and smooth finish without roller marks.
After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.

Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

Joints

Construct joints to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

Clean contact surfaces and apply tack coat.

Offset longitudinal joints in successive courses a minimum of 6 inches.

Offset transverse joints in successive courses a minimum of 24 in.

Construction transverse joints by bulkhead method or sawed vertical face method as described in ‘The Asphalt Handbook’.

Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
Compact asphalt at joints to a density within 2 percent of specified course density.

Compaction

General: begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers. Complete compaction before mix temperature cools to 185 deg. F.

Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and re-rolling to required elevations.

Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

Place to density requirements of drawings, or as directed by the Engineer or Owner.

Average Density; 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.

Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges whiles still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.

Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

Tolerances

Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

Base Course: 1/4 inch.

Surface Course: 1/8 inch.

Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

Scheduled Compacted Thickness: Compact each course to produce the thickness indicated within the following tolerances:

Base Course: Per Section 02207, “Aggregate Material”.

Surface Course: Plus 1/4 inch, no minus.

Variation from True Elevation: Within +/-0-.05 feet.

Surface Treatments

Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq.yd. (0.45 to 0.70 L/sq. M) to existing asphalt pavement and allow to cure. Lightly dust areas receiving excess fog seal with a fine sand.

Pavement Markings

Apply pavement markings per Section 2580 Pavement Markings.

QUALITY CONTROL

Testing Laboratory Services – Provide mix design for asphalt specifically designed for this project as indicated in these specifications

Submit proposed mix design for review and approved by Engineer or Owner prior to beginning of Work.

Test samples in accordance with these specifications. Submit test results that confirm mix design compliance to Engineer or Owner for review prior to beginning of Work.

Testing Agency - Owner will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.

Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

Additional testing, at Contractors expense, will be performed to determine compliance of corrected work with specified requirements.

Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D3549.

Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

In-Place Density - Samples of un-compacted paving mixtures and compacted pavement will be secured by testing agency according to ASDTM D979.

Reference laboratory density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 1559, and compacted according to job-mix specifications.

Reference maximum theoretical density will be determined by averaging results from 4 samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.

In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

One core sample will be taken for every 1000 sq. yd. or less of installed pavement, but in no case will fewer than 3 cores be taken.

Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726. One test per 1000 sq. yd. or less will be taken on installed pavement.

Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

Immediately after placement, protect pavement from mechanical injury for seventy-two (72) hours or until surface temperature is less than 140 degrees F (60 degrees C).

SECTION 02755

PLANTMIX ASPHALTIC CONCRETE PAVEMENTS - GENERAL

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

These Specifications include general requirements applicable to all types of asphaltic concrete pavements of the plantmix type irrespective of gradation of aggregate, kind, and amount of bituminous materials, or pavement use.

Work consists of one or more courses of asphaltic concrete mixture constructed on the prepared foundation in accordance with these specifications and the specific requirements of the type under contract, and in conformity with the lines, grades, thicknesses, and typical cross sections shown on the Drawings or established by the Engineer or Owner.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

References

Pavement sections shall be designed in accordance with the 1993 AASHTO Guide for Design of Pavement Structures. The following parameters, based upon the AASHTO Guide and the 1996 Nevada Department of Transportation Pavement Structural Design and Policy Manual, shall be used in the design calculations.

The design shall be stamped and signed by a professional engineer registered in the state of Nevada.

The reliability factor will be a minimum of 80 percent with a standard normal deviate (ZR) of -0.841 for all pavements on the UNLV Campus.

The standard deviation will be 0.45.

The initial service index will be 4.2 and the final service index 2.5 for all classifications.

Drainage coefficients shall not exceed 1.0.

The structural coefficient for asphalt will be 0.35.

For materials meeting Section 02207, “Aggregate Material,” the elastic modulus shall be 25,000 psi and the structural coefficient shall be 0.12.

If required on a project, soil testing will be performed in accordance with ASTM D2844 or AASHTO T190 to determine a representative Resistance (R) value for the prepared subgrade. The subgrade shall be prepared in accordance with the Geotechnical Soils Investigation Report, and soil sampling performed subsequent to rough grading to confirm the original results. An average of the R-values may be used if the soil classification results are consistent, or if the values do not differ by more than 10. The minimum testing requirements are 1 right-of-way R-value test and post grading soil classifications every 1,000 linear feet of roadway, with a minimum of 2 classifications per project.

The subgrade R-value (psi) shall be converted to a Resilient Modulus (MR, psi) using the following correlation: MR=145*(10ˆ((0.0147*R)1.23)).

The minimum AC sections are 2.5 inches for parking stalls, 3.0 inches for drive aisles, 3.5 inches for entry roads.

All designs require a minimum of 4 inches Type II aggregate base material.

The subgrade shall be scarified and recompacted to a minimum of 95 percent, to minimum depth of 8 inches.

The minimum design equivalent axial loads (EAL) based on a 20-year design are 7.2E+3 for parking drive aisles and campus entry roads.

PRODUCT STANDARDS

Mixture Composition

The asphaltic concrete plantmix shall be composed of a mixture of aggregate, mineral filler if required, and bituminous material. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resulting mixture meets the grading requirements of the job-mix formula.

Before starting work, the contractor shall submit a proposed job-mix formula in writing, for use by the Engineer in setting the job-mix formula to be used.

The proposed job-mix formula shall be determined by a testing laboratory under the direction and control of a registered professional engineer, based on tests performed in accordance with the "Marshall Method of Mix Design" as described in the Asphalt Institute Manual Series No. 2 (MS-2), latest edition.

The number of compaction blows to be applied to the specimens will be based on the appropriate traffic category.

Traffic Category II will use a 50-blow design and will apply to parking lots, drive aisles, and campus entry roads.

Unless otherwise specified, voids determinations and effective asphalt contents will be determined and reported in accordance with procedures described herein.

The job-mix formula shall be selected in accordance with the following procedures:

Determine asphalt content required for 4 percent air voids

Determine the average asphalt content for:

Maximum density.

Maximum stability.

Four (4) percent air voids.

The lower of the asphalt contents obtained for a. or b. above will be used as the design asphalt content for the job-mix formula.

The job-mix formula asphalt content shall satisfy all Marshall Design Criteria as shown in the following table:

Marshall Design Criteria

TRAFFIC CATEGORY	II TRAFFIC INDEX (TI) < 7.0	
Compaction Blows Each End of Specimen	50	
Test Property	Min.	Max.
Stability, Lb.	1500	-
Flow, 0.01 In.	8	16
Percent Total Air Voids	3	5
Percent Voids Filled With Asphalt	65	78
Minimum Voids in Mineral Aggregate-Percent	*	*

* See Table in Asphalt Institute MS-2 Manual

In addition to the Marshall Design Criteria set forth herein, the job-mix formula shall also meet the following tensile strength requirements for all traffic categories:

Test Property	Test Method	Requirements
Indirect Tensile Strength (Unconditioned)	AASHTO T283	65 psi minimum (50 psi minimum with AC-10 Asphalt)
Indirect Tensile Strength (Retained Strength)	AASHTO T283	70 percent minimum

Should the job-mix formula fail to meet the tensile strength requirements, the Contractor shall add hydrated lime (hereinafter referred to as mineral filler) to the plantmix bituminous aggregates as specified in Subsection 3.8, “Preparation of Aggregates.” If the addition of mineral filler fails to achieve the minimum tensile strengths, the contractor will be required to change sources of material, and submit a new job-mix formula that will satisfy all design criteria.

The test report shall show the curves and data tabulations used to determine the following characteristics:

Unit weight per cubic foot.

Percentage of air voids.

Percent voids filled with asphalt.

Marshall stability.

Percent voids in mineral aggregate (VMA).

Marshall flow.

Indirect tensile strength (Unconditioned and Retained strength).

Data tabulations shall include indications of the water absorption, aggregate bulk specific gravities for both coarse (retained on No. 8 sieve) and fine (passing No. 8 sieve) aggregate, theoretical specific gravity of bituminous mixture, absorbed asphalt, and effective asphalt content as determined in accordance with referenced Asphalt Institute procedures. ASTM D2041 will be used for determination of theoretical maximum specific gravity of bituminous paving mixtures.

The test report shall give the recommended asphalt content and the values for:

Unit weight per cubic foot (bulk density).

Stability.

Flow.

Air voids.

Voids filled with asphalt.

Voids in mineral aggregate (VMA).

Indirect tensile strength (Unconditioned and Retained strength).

The formula submitted shall propose definite single values for:

The percentage of aggregate passing each specified sieve.

The percentage of bitumen to be added (to 0.1 percent) based on weight of total mix.

The percentage of mineral filler to be added to the aggregate.

The temperature of the mixture leaving the mixer.

The temperature of the mixture in the hopper of the paving machine.

The job-mix formula aggregate with the allowable tolerances herein shall conform to Section 02756 "Aggregates for Asphaltic Concrete Courses," for plantmix bituminous base aggregates, plantmix bituminous surface aggregate, or plantmix bituminous open-graded aggregate, as applicable.

The Engineer or Owner will determine a job-mix formula with single values for Subsection 2.1, J.1-5, and so notify the Contractor in writing. This job-mix formula shall not be modified except with the written approval of the Engineer or Owner. The mix furnished shall conform to this job-mix formula, within the following range of tolerances:

Aggregate passing the No. 4 and larger sieves: ±7 percent.

Aggregate passing the No. 8 to No. 100 sieves: ±4 percent.

Aggregate passing the No. 200 sieve: ±2 percent, but not to exceed upper limit of specification. Mineral filler is not considered as part of the aggregate.

Bitumen content: ±0.3 percent.

Temperature leaving the mixer: ±20 degrees F.

Temperature in hopper of paving machine: ±20 degrees F.

Should there be a change in sources of material, a new job-mix formula shall be established before the new material is used. Check tests of properties of the plantmix bituminous materials shall be made on the first day of production and as requested by the Engineer or Owner during period of construction to confirm that all properties are in compliance with Marshall Design Criteria and tensile strength requirements. Adjustments in gradation, mineral filler content, and asphalt content shall be made as necessary to meet design criteria.

The temperature of the bituminous material just prior to mixing and of the completed mixture in the hauling vehicle just prior to leaving the plant shall conform to the following table:

Plantmix Bituminous Mixture with Asphalt Cement

Grade of Asphalt Cement	Bituminous Material		Plantmix Bituminous Base of Surface Mixtures	
	Min.	Max.	Min.	Max.
PG76-22CC, PG64-34CC	275°F	350°F	275°F	350°F
AC-40	275°F	350°F	255°F	350°F
AC-20, AC-30	265°F	330°F	245°F	325°F
AC-10	255°F	325°F	235°F	325°F
AC-20P	280°F	350°F	300°F	350°F

<u>Aggregates</u>

Aggregates shall comply with Section 02756, “Aggregates for Asphaltic Concrete Courses.”

<u>Commercial Mineral Filler</u>

Commercial mineral filler shall comply with Section 02756, Subsection 2.2.A,”Commercial Mineral Filler.”

<u>Bituminous Materials</u>

The bituminous material shall comply with Section 02758, “Bituminous Materials.” Bituminous material may be conditionally accepted at the source.

Unless otherwise specified in writing by the Engineer or Owner, for Category II pavements the grade of bituminous material for dense-graded mixes shall be AC-30 or AC-20 asphalt cement. The grade may be changed one step by the Engineer or Owner.

Certificates of Compliance for the asphalt, showing test values necessary for specification compliance, shall be made available upon request by the Engineer or Owner.

<u>Field Compaction and Mix Design Correlation</u>

Type 2 coarse mix design annual submittals only.

In an effort to establish the “point of refusal,” if it has been determined that the in-place air voids are less than 6 percent or more than 8 percent, the mix design bitumen content shall be adjusted. This procedure will be required as a part of all new mix designs, and any field adjustment shall be noted.

The field compaction shall be as required in Section 3.11, “Rolling and Compaction.”
The in-place air voids, as based on the Maximum Theoretical Specific Gravity and 10 correlated nuclear tests or 5 cores, shall then be calculated.

If the mean percent air voids is outside the limits noted above, the bitumen content shall be mathematically increased or reduced and noted on the mix design submittal. If adjustment is made, then a new control strip is required.

Once the control strip meets the above requirements, it becomes the control strip for subsequent mix placements.

Subsequent compaction testing lots shall be tested in accordance with Section 3.12, “Acceptance Sampling and Testing of Bituminous Mixture.” If the compliance cannot be maintained between the above limits, a new control strip shall be implemented to re-establish the mean density for testing.

INSTALLATION GUIDELINES

Bituminous Mixing Plant

Sufficient storage space shall be provided for the aggregate, or for each size aggregate when required. The storage yard shall be maintained neat and orderly and the stockpile, or separate stockpiles when required, shall be readily accessible for sampling.

Mixing plants shall be of sufficient capacity and coordinated to adequately handle the proposed bituminous construction.

Mixing Plants. Plants used for the preparation of bituminous mixtures shall conform to the following requirements:

Equipment for Preparation of Bituminous Material:

Tanks for the storage of bituminous material shall be equipped to heat and hold the material at the required temperatures.

The heating shall be accomplished by steam coils, electricity, or other approved means so that no flame shall be in contact with the tank or contents.

The circulating system for the bituminous material shall be designed to ensure proper and continuous circulation during the operating period.

Provisions shall be made for measuring and sampling storage tanks.

Drier: The plant shall include a drier or driers which continuously agitate the aggregate during the heating and drying process.

Thermometric Equipment:

An armored thermometer of adequate range in temperature reading shall be fixed in the bituminous feed line at the suitable location near the charging valve at the mixer unit.

The plant shall be equipped with either an approved dial-scale, mercury-actuated thermometer, an electric pyrometer, or other approved thermometric instrument so placed at the discharge chute of the drier as to register automatically or indicate the temperature of the heated aggregate.

The Engineer or Owner may require replacement of any thermometer by an approved temperature-recording apparatus for better regulation of the temperature of aggregates

Smoke and Dust Control:

The Contractor will be required to install satisfactory precipitation devices, or use other methods which will meet local conditions, city and county regulations as set forth by the Clark County Air Pollution Control Officer, and state laws pertinent to air pollution.

Truck Scales:

Bituminous mixture shall be weighted on approve scales furnished by the Contractor or on public scales at no cost to UNLV. Such scales shall be platform scales.

Safety Requirements:

Adequate and safe stairways to the mixer platform and sampling points shall be provided and guarded ladders to other plant units shall be placed at all points where accessibility to plant operations is required. Accessibility to the top of truck bodies shall be provided by a platform or other suitable device to enable the Engineer or Owner to obtain sampling and mixture temperature data. A hoist or pulley system shall be provided to raise scale calibration equipment, sampling equipment, and other similar equipment from the ground to the mixer platform and return. All gates, pulleys, chains, sprockets, and other dangerous moving parts shall be thoroughly guarded and protected. Ample and unobstructed passage shall be maintained at all times in and around the truck loading area. This area shall be kept from drippings from the mixing platform.

Batching Plant: Batch mixing plants shall confirm to the following requirements:

Plant Scales:

Scales shall be accurate to 0.5 percent of the minimum load that may be required. Poises shall be designed to be locked in any position to prevent unauthorized change of position.

In lieu of truck scales, the Contractor may provide an approved automatic printer system which will print the weights of the material delivered, provided the system is used in conjunction with an approved automatic batching control system. Such weights shall be evidenced by a weight ticket for each load.

The amount of filler material shall be determined by weighing on springless dial scales separate from the plant weigh hopper or by some method that uniformly feeds the mixer within 10 percent of the required amount.

Feeder for Drier:

The plant shall be provided with accurate mechanical means for uniformly feeding the aggregate into the drier so that uniform production and uniform temperature will be obtained.

Screens:

Plant screens capable of screening the aggregate to the specified sizes will be required.

Bins:

The plant shall include storage bins of sufficient capacity to supply the mixer when it is operating at full capacity.

Bins shall be arranged to ensure separate and adequate storage of appropriate fractions of the mineral aggregates.

Separate dry storage shall be provided for mineral filler when used and the plant shall be equipped to feed such material into the mixer.

Each bin shall be provided with overflow pipes, of such size and at such locations as to prevent backing up of material into other compartments or bins.

Each compartment shall be provided with its individual outlet gate constructed so that when closed there shall be no leakage.

The gates shall cut off quickly and completely.

Bins shall be so constructed that samples representative of the entire material in the bin can be readily obtained.

Weigh Box or Hopper:

All materials shall be proportioned by weight.

Aggregate scales shall be one of the following:

Multiple beam scales.

Springless dial type scale.

Fully automatic solid-state digital strain gauge transducer measuring device.

Aggregate scales shall have a capacity exceeding 1-1/4 times the total amount of materials to be weighed in one operation. Each scale gradation shall be approximately 1/1000 of the total capacity of the scale.

All scales used for proportioning materials shall be accurate to within 1 percent.

The scales shall be sealed and certified by the State Sealer of Weights and Measures.

Certifications shall be dated within the past 12 months and shall be renewed whenever required by the Engineer or Owner.

If the plant is moved, a new certificate will be required.

All scales shall be of such size and so arranged that they may be read easily from the operator's platform.

The scales shall indicate the true net weight without the application of any factor.

The dials of scales shall not be less than 12 inches in diameter.
The figures on the scale dials shall be clearly legible.

Weighing equipment shall be so insulated against the vibration or movement of other operating equipment in the plant that the error in weighting with the entire plant running will not exceed 1-1/2 percent for any batch.

Bituminous Control Unit:

Satisfactory means, either by weighing or metering, shall be provided to obtain the proper amount of bituminous material in the mix within the tolerance specified. Means shall be provided for checking the quantity or rate of flow of bituminous material into the mixer.

Bituminous Control:

The equipment used to measure the bituminous material shall be accurate to plus or minus 0.5 percent.

The bituminous material bucket shall be a non-tilting type with a loose sheet metal cover.

The length of the discharge opening or spray bar shall be not less than three-fourths the length of the mixer and it shall discharge directly into the mixer.

The bituminous material bucket, its discharge valve or valves, and spray bar shall be adequately heated.

Steam Jacket, if used, shall be efficiently drained and all connections shall be so constructed that they will not interfere with the efficient operations of the bituminous scales.

The capacity of the bituminous material bucket shall be at least 15 percent in excess of the weight of bituminous material required in any batch.

The plant shall have an adequately heated quick-acting, non-drip, charging valve located directly over the bituminous material bucket.

Bituminous material shall be measured by means of springless dial scales or metering devices. Springless dial scales shall have a capacity of not more than 1,000 pounds in 2-pound gradations.

The indicator dial shall have a capacity of at least 15 percent in excess of the quantity of bituminous material used in a batch.

The controls shall be constructed so that they may be locked at any dial setting and will automatically reset to that reading after the addition of bituminous material to each batch.

The dial shall be in full view of the mixer operator.

The flow of bituminous material shall be automatically controlled so that it will begin when the dry mixing period is over.

All of the bituminous material required for one batch shall be discharged in not more than 15 seconds after the flow has started.
The size and spacing of the spray bar openings shall provide a uniform application of bituminous material the full length of the mixer.

The section of the bituminous line between the charging valve and the spray bar shall be provided with a valve and outlet for checking the accuracy of the meter when a metering device is substituted for a bituminous material bucket.

Mixer:

The batch mixer shall be a twin pugmill type, steam jacketed, or heated by other approved means and capable of producing uniform mixtures within the specified tolerances.

It shall be equipped with a sufficient number of paddles or blades set improper order and operated at such speed as to produce a properly and uniformly mixed batch.

At the beginning of the mixing operation, the clearance between paddle tips and liner shall not exceed half the maximum aggregate diameter for the specified job-mix.

The clearance of the paddles or blades from all fixed and moving parts shall not exceed 1 inch.

Badly worn or defective paddles or blades shall not be used in mixing operations.

Control of Mixing Time:

The mixer shall be equipped with an accurate time lock to control the operations of a complete mixing cycle.

It shall lock the weigh box gate after the charging of the mixer until the closing of the mixer gate at the completion of the cycle.

It shall lock the mixer gates throughout the dry and wet mixing period.

The dry mixing period is defined as the interval of time between the opening of the weigh box gate and the start of introduction of bituminous material.

The wet mixing period is the interval of time between the start of introduction of bituminous material and the opening of the mixer gate.

The mixer shall be equipped with a timing device which will indicate by a definite audible or visual signal the expiration of the mixing period.

The device shall measure the time of mixing within an accuracy of 2 seconds.

A suitable automatic device for counting the number of completely mixed batches shall be provided and maintained in proper working condition.

When the aggregate and the bituminous material have been combined, the entire mass shall be mixed in an approved mixer.

The mixing shall continue until homogeneity and a uniform coating are achieved.

The output rate shall not exceed the manufacturer’s capacity rating.

Drier Drum Mixing Plants:

Drier drum mixing plants shall conform to the following requirements:

Aggregate Stockpiles: Comply with Subsection 3.08, paragraphs A through C.

Aggregate Proportioning:

The plant shall include a means for accurately proportioning each bin size of aggregate prior to the drying operation.

The plant shall have a mechanical feeder mounted under each compartment bin.

Each compartment bin shall have an accurately controlled individual gate for volumetrically measuring the material drawn from each compartment.

The feeding office shall be rectangular with one dimension adjustable by positive means.

Indicators shall be provided for each gate to show the respective gate opening in inches.

A meter for determining the rate of each feeder, or a revolution counter, shall be provided. Commercial filler material introduced into the mixer shall be drawn from storage bins by a continuous mechanical feeder which will uniformly feed the mixer within 10 percent of the required amount.

Weight Calibration of Aggregate:

The plant shall include a means for calibration for each aggregate feeder by weighing test samples.

Bituminous Metering Device:

The bituminous material shall be introduced into the mixer through a gallonage meter by a positive displacement metering device, equipped with a ready means of varying the bituminous material delivery rate.

Synchronization of Aggregate Feed and Bituminous Material Feed:

Satisfactory means shall be provided to afford a positive interlocking control between the flow of aggregate from each feeder and the flow of bituminous material.

The interlocking control shall indicate a visible or audible signal when the level of material in any one feeder approaches the strike off capacity of the fee gate, or shut the plant down.

Mixer:

The plant shall include a mixing device which will obtain homogeneity and a uniform coating.

The mixing output shall not exceed the manufacturer’s capacity rating.
The moisture content of the bituminous mixture shall not exceed 3 percent at the discharge end of the dryer.

Surge Bins:

The plant will be equipped with an approved surge bin at the discharge. This surge bin will be in excess of 20 tons, and shall be equipped with an approved surge batcher or other approved method satisfactory to the Engineer or Owner that will prevent segregation of the bituminous mixture as it is being discharged into the hauling vehicle.

Hauling Equipment

Trucks used for hauling bituminous mixtures shall be tight, clean, smooth beds which have been thinly coated with a minimum amount of paraffin oil, lime solution, or other approved material to prevent the mixture from adhering to the beds.

Pavers

Bituminous pavers shall be self-contained, self-propelled units provided with an activated screed or strike-off assembly, heated if necessary, and capable of spreading the finishing courses of bituminous plantmix material in lane widths applicable to the specified typical section and thicknesses shown on the plans.

Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of bituminous plantmix material in widths shown on the drawings, or as directed by the Engineer or Owner.

The asphalt paver shall operate independently of the vehicle being unloaded and shall be capable of propelling the vehicle being unloaded in a satisfactory manner.

If necessary, the load of the haul vehicle shall be limited to that which will ensure satisfactory spreading.

While being unloaded, the haul vehicle shall be in contact with the machine at all times, and the brakes on the haul vehicle shall not be depended upon to maintain contact between the vehicle and the machine.

Pavers shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed.

The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

Pavers shall be capable of placing the bituminous mixture to meet the surface tolerances specified under the respective sections of bituminous pavement.

Rollers

Rollers shall be vibratory, steel-wheeled or pneumatic-tired type, in good condition.

Rollers shall be capable of reversing without backlash and operating at slow speeds to avoid displacement of the bituminous mixture.

The number, type, and weight of roller shall be sufficient to compact the mixture to the required density without detrimentally affecting the completed material as determined by the Engineer or Owner.

Comply with Subsection 3.11. “Rolling and Compaction.”

Rollers for the test strip shall meet the following requirements:

Breakdown rollers shall be either a 3-wheeled steel roller or a 2-axle tandem or a 3-axle tandem weighting not less than 10 tons.

Except as hereinafter permitted, pneumatic-tired roller shall comply with the following:

Rollers shall consist of not less than 9 wheels equipped with pneumatic tires of equal size and diameter.

Tires shall be mounted on 2 axles attached to a rigid frame, equipped with a loading platform or body suitable for ballast loading, so that the total weight of the roller can be varied to produce an operating weight per tire of between 1,000 and 2,000 pounds.

The tires shall have treads satisfactory to the Engineer or Owner.

The tires on the rear axle shall be so spaced that the entire gap between adjacent tires on the front axle will be covered by 1 tread of the following tires.

The tires shall be uniformly inflated so that the air pressure in the several tires will not vary more than 5 pounds per square inch. Inflation pressure in pounds per square inch shall be the tire manufacturer's recommendation.

Minimum tire size shall be 7.50 x 15 inches, 4 ply.

The use of pneumatic-tired rollers with fewer wheels and a greater maximum operating weight per tire than that specified herein will be permitted subject to the following requirements:

The minimum width between the outer edge of the outside tires on a given axle shall be 60 inches.

The weight of the roller and the tire pressure can be varied to produce a ground contact pressure between 50 and 70 psi.

The finish roller shall be a 2-axle tandem weighing not less than 8 tons.

Weathering Limitations

The bituminous mixture shall not be placed upon any wet surface or when the surface temperature of the underlying course is less than specified in Table 1. The temperature requirement may be modified, but only when so directed by the Engineer or Owner.

TABLE 1 – BASE TEMPERATURE LIMITATIONS

Mat Thickness	Base Temperature (Minimum °F)
3 inches or Greater	40
Greater than 1 inch but less than 3	45

inches	
1 inch or Less	50

Preparation of Existing Surface

When the surface of the existing pavement or old base is irregular, it shall be brought to a uniform grade and cross section as shown on the plans.

The subgrade to receive asphalt concrete, or asphalt concrete base immediately prior to applying prime coat, shall conform to the compaction and elevation tolerance specified for the material involved and shall be free of loose or extraneous material.

If the plantmix bituminous surface is being constructed directly upon an existing hard-surfaced pavement, a tack coat of grade CSS-1h or SS-1h emulsified asphalt, diluted 50/50 at an approximate rate of 0.05 to 0.10 gallons per square yard, shall be uniformly applied upon the existing pavement preceding the placement of the asphalt concrete.

The surface shall be free of water, foreign material, or dust when the tack coat is applied.
To minimize public inconvenience, not greater area shall be treated in any one day than is planned to be covered by plantmix during the same day, unless otherwise authorized by the Engineer or Owner

A similar tack coat shall be applied to the surface of any previous course placed longer than 24 hours, or if a satisfactory bond cannot be obtained between the surface and a succeeding course, as determined by the Engineer or Owner.

The contact surfaces of all cold pavement joints, curbs, gutters, manholes, and similar structures shall be painted with grade CSS-1h or SS-1h emulsified asphalt immediately before the new asphalt concrete is placed. Comply with Section 02752, “Asphaltic Concrete Paving.”

When specified in the contract, longitudinal and transverse joints and cracks shall be sealed by the application of an approved joint sealing compound before spreading the mixture upon a Portland cement concrete surface. Excess bituminous material shall be removed from joints and cracks prior to spreading the mixture.

Preparation of Bituminous Materials

The bituminous material shall be heated to the specified temperature in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature at all times.

Preparation of Aggregates

Aggregates proportioned prior to the heating and drying process shall be separated into at least two general sizes:

That portion of the material having a minimum of 80 percent passing No. 4 sieve.

That portion of the material having a minimum of 80 percent retained on a No. 4 sieve.
The material shall be maintained within the limits above with a uniformity of plus or minus 5 percent. Each portion of the material shall be stored separately.

When moving the aggregate from storage to compartment bins, any method may be used which will not cause segregation, degradation, or combinations of aggregate which fail to meet the specified gradation requirement. Plantmix operations shall not commence until sufficient aggregate material is stockpiled to ensure one day's run.

Aggregate proportioned immediately after the heating and frying process shall be screened into a minimum of 2 fractions when minus ½-inch aggregate is used, and into a minimum of 3 fractions when larger sized aggregate is used. The screened material shall be conveyed to separate compartments ready for proportioning and mixing with bituminous material.

If the Contractor elects to introduce baghouse fines into the mix, the material shall be drawn from a storage facility in which the material is kept in a uniform free flowing condition.

The baghouse fines for delivery to the plant shall be from a vane type metering device which is interlocked (electrical driven feeders shall be activated from the same circuit) to the flow of each aggregate feeder.

The drive shaft on the baghouse fines vane feeder shall be equipped with a revolution counter accurate to 1/10 of a revolution, and a means for varying the rate.

In a continuous mix and/or dryer drum plant, the baghouse fines shall be added at the asphalt feed line to ensure a uniform mix.

In batch plants, the baghouse fines shall be added by the use of a separate bin.
The baghouse fines shall be introduced at a point as approved by the Engineer or Owner at a percentage determined by the Engineer or Owner not to exceed 2 percent by dry weight of the aggregate.

Baghouse fines shall be considered as part of the aggregate, and not as a mineral filler.

If mineral filler is required to meet the tensile strength requirements of the job-mix formula, it shall be added by one of the following methods:

Cold Feed Method:

Hydrated lime (hereinafter referred to as mineral filler) shall be added to all plantmix bituminous aggregates at the rate of not less than 1 percent nor more than 2-1/2 percent of the weight of the fry aggregate. The exact rate of application shall be as determined by the job-mix formula.

Mineral filler shall be drawn from a storage facility in which the mineral filler is agitated by air or other means to keep it in a uniform free flowing condition.

The mineral filler for delivery to the mixer shall be from a vane type metering device which is interlocked, (Electrical driven feeders shall be actuated from the same circuit) to the flow of each aggregate feeder.

The drive shaft on the mineral filler vane feeder shall be equipped with a revolution counter reading to 1/10 of a revolution, and a means for varying the rate.

In continuous mix and/or drum dryer plants, the mineral filler shall be added to the aggregate after the aggregate is proportioned.

In batch plants, the mineral filler shall be added to the aggregate prior to drying.

Regardless of which type of plant is used, the following methods shall be utilized:

Prior to the introduction of the mineral filler, sufficient moisture shall be added using spray bars at the aggregate bins to bring the aggregate to a moisture content where enough free surface moisture is available to thoroughly wet the aggregate and wet the lime.

This content shall be a minimum of 4 percent.

The actual amount of moisture required will be determined by the Engineer or Owner.

After the addition of water and mineral filler, the aggregate shall be mixed using a horizontal twin-shaft pugmill.

The mixing paddles shall be adjustable for angular position on the shaft to permit altering of the mixing pattern or retarding the flow to ensure that the aggregate is thoroughly coated with mineral filler.

The volume of material in the pugmill shall not extend above the vertical position of the blade tips.

The compound mixture shall be directly introduced into the hot plant.

Stockpiling of the completed mixture is strictly prohibited.

The moisture control valve shall be interlocked with the hot plant control room so the moisture control valve is automatically turned off when the cold fee belts are shut off. The control valve shall also turn on automatically when the cold feed belts are activated.

Marination Method:

Hydrated lime (hereinafter referred to as mineral filler) shall be added to all fractions of the plantmix bituminous aggregates.

The coarse aggregates shall be wet cured with mineral filler at a rate of 1 percent of the weight of dry aggregate.

The fine aggregates shall be wet cured with mineral filler at a minimum rate of 2 percent of the weight of the dry aggregate.

The aggregates shall be marinated (wet cured) in the stockpiles for a minimum of 48 hours.

The wet cured aggregate in the stockpile shall be used within 45 calendar days. Materials marinated in stockpile in excess of 45 calendar days shall not be used for the production of plantmix bituminous aggregates unless otherwise approved by the engineer or Owner.
Prior to the introduction of the mineral filler, sufficient moisture shall be added using spray bars at the aggregate bins to bring the aggregates to a moisture content where enough free surface is available to thoroughly wet the aggregate and activate the lime.

This content is recommended to be a minimum of 3 percent for coarse aggregates and 6 percent for the fine aggregates.

The actual amount of moisture required will be determined by the Engineer or Owner.

After the addition of water and mineral filler, the aggregates shall be mixed using a horizontal twin-shaft pugmill.

The mixing paddles shall be adjustable for angular position on the shaft to permit altering of the mixing pattern or retarding the flow to ensure that the aggregate is thoroughly coated with mineral filler.

The volume of material in the pugmill shall not extend above the vertical position of the blade tips.

Mineral filler shall be drawn from a storage facility in which the mineral filler is agitated by air or other means to keep it in a uniform free flowing condition.

The mineral filler for delivery to the mixer shall be from a vane type metering device which is interlocked (electrical driven feeders shall be actuated from the same circuit) to the flow of each aggregate feeder.

The drive shaft on the mineral filler vane feeder shall be equipped with a revolution counter reading to 1/10 of a revolution, and a means for varying the rate.

Slurry Method:

Hydrated lime or slaked quicklime (hereinafter referred to as mineral filler) shall be added to all plantmix bituminous aggregates in slurry form.

Add at a rate of not less than 1 percent nor more than 2-1/2 percent of dry mineral filler based on the weight of the dry aggregate.

The exact rate of application shall be as determined by the job-mix formula.

A slurry containing 1 part mineral filler and 2 parts water by weight is recommended.

The actual amount of water required in the production of the slurry will be determined by the Engineer or Owner after a visual inspection to ensure that the aggregate is thoroughly and uniformly coated with the mineral filler.

This addition of moisture to the aggregate prior to mixing of the mineral filler and aggregate will not normally be required.

The slurry shall be prepared in a central mixing tank provided with agitation for keeping the mineral filler in suspension until applied to the aggregate.

The slurry mixing tanks shall be capable of producing sufficient slurry for the hot mix asphalt manufacturing facility production rate, and shall produce a uniform slurry consistency.

The plant shall be equipped with suitable pumps and meters for introducing the required amount of slurry to the aggregate. A suitable device shall be provided to the Engineer or Owner for determining the weight of mineral filler per gallon of slurry.

If quicklime is used as the mineral filler, it shall be converted to hydrated lime by using one or more slaking tanks. The slaking unit shall be capable of:

Complete slaking or hydration of the quicklime.

Providing agitation for mixing and keeping the mineral filler in suspension until use.

After the addition of the mineral filler slurry, the aggregate shall be mixed using the horizontal twin-shaft pugmill.

The mixing paddles shall be adjustable for angular position of the shaft to permit altering of the mixing pattern or retarding the flow to ensure that the aggregate is thoroughly coated with mineral filler.

The volume of material in the pugmill shall not extend above the vertical position of the blade tips.

The completed mixture shall be directly introduced into the hot plant.

Stockpiling of the completed mixture is strictly prohibited.

<u>Mixing</u>

The permissible moisture content of the bituminous mixture just behind the paver shall not exceed 1-1/2 percent as determined by test method ASTM D1461 or equivalent.

Should the aggregate contain excessive moisture when heated within the temperature limits, the Contractor will be required to take satisfactory corrective action before resuming plantmix operations.

When an approved dryer drum mixing process is used, the moisture content of the bituminous mixture at discharge from the mixer shall not exceed 3 percent, and the resulting product at the discharge end of the direr shall be a homogenous mixture of uniformly distributed and properly coated aggregates of unchanging appearance.

The drier aggregate shall be combined in the mixer in the amount of each fraction of aggregates required to meet the job-mix formula. The bituminous material shall be measure or gauged and introduced into the mixer in the amount specified by the job-mix formula.

Commercial filler material, when required, shall be added to the mixer separately and shall be thoroughly dry. If the materials are mixed in a batching plant, the filler material shall be fed directly into the mixer as near the center as possible.

The time of mixing a batch shall begin on the charging stroke of the weight hopper dumping mechanism and shall end when discharge is started.

Mixing shall continue until a homogenous mixture of uniformly distributed and properly coated aggregates of unchanging appearance is produced.

In general, the time of mixing shall not be less than 30 seconds, except that the time may be reduced when, in the opinion of the Engineer or Owner, the sizes of aggregates are uniformly distributed and all particles are thoroughly and uniformly coated with asphalt binder.

The output rate shall not exceed the manufacturer's capacity rating.

Should the mixture, at the plant or in place, show an excess or deficiency of bitumen, show injury or damage due to burning or overheating or show an improper combination of aggregates, due to the Contractor's failure to conform to the specified requirements, it shall be rejected and if still in the truck, shall be disposed of as required. If an unsatisfactory mix, as referred to above, has been placed, it shall be disposed of and replaced as directed. No compensation will be allowed for rejected material.

Spreading and Finishing

The mixture shall be laid upon an approved surface, and shall be spread and struck off to the grade and elevation established. Bituminous pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable.

The forward rate of travel of the paving machine(s) shall be regulated to a speed dependent upon the capacity of the mixing plant to furnish the mixture and the rate at which the roller can obtain the required compaction. The machine shall be operated so that material does not accumulate and remain along the sides of the receiving hopper.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the mixture shall be spread, raked, and compacted by hand tools. For such areas, the mixture shall be dumped, spread, and screeded to give the required compacted thickness, correct grade, and cross section.

The Contractor may window plantmixed bituminous base or surface material in front of the spreading and finishing machine, provided that the following conditions and requirements are strictly adhered to:

The window is properly sized, thereby ensuring the delivery of the correct amount of material to the spreading and finishing machine at all times.

The bituminous mixture shall be transferred from the windrow to the spreading and finishing machine in such a manner that the materials in the spreading machine will be a uniform mixture. The base upon which the windrow was formed shall not be disturbed, and there shall be no paving material remaining on this base between the pickup device and the spreading and finishing machine.

The temperature requirements for the material in the hopper of the spreading and finishing machine are complied with. Plantmix bituminous mixture that does not meet the minimum temperatures specified shall not be incorporated in the work, but shall be wasted in a manner satisfactory to the Engineer or Owner.

Should any course of bituminous mixture placed by utilizing a windrow be interior, as determined by the Engineer or Owner, to that placed by transferring the bituminous mixture directly from the hauling vehicle to the spreading machine, the use of a windrow shall be discontinued.

The bituminous mixture spread through the paving machine during one day's operation shall come from a single plant manufacturer. Intermixing from more than one source shall not be allowed.

Rolling and Compaction

The initial or breakdown rolling shall consist of one complete coverage of the bituminous mixture with a steel-wheeled roller.

Initial rolling shall commence at the lower edge and shall progress toward the highest portion of the roadbed.

Under no circumstances shall the center be rolled first.

The initial or breakdown rolling shall be followed by rolling such that uniform density is obtained throughout the depth of the layer of the material being compacted.

At least two rollers, one steel-wheeled, the other pneumatic-tired, shall be used.

The total number of roller used shall be sufficient to obtain the required compaction while the mixture is in a workable condition.

The final rolling of the bituminous mixture shall be performed with the same type of roller used for breakdown rolling.

Rolling shall be performed in such a manner that cracking, shoving, or displacement will be avoided.

All rollers shall be in good condition and the reversing mechanism maintained so that the roller is capable of changing directions smoothly.

The roller shall be kept in continuous motion while rolling so that all parts of the pavement receive equal compression.

The motion of the roller shall be slow enough at all times to avoid displacement of the pavement.

Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected immediately by the use of rakes and fresh mixture when required.

To prevent adhesion of the mixture to the roller, the wheels shall be kept properly maintained.

The use of diesel oil on pneumatic-tired rollers shall be kept to a minimum as determined by the Engineer or Owner.

Acceptance Sampling and Testing of Bituminous Mixture

At no cost to UNLV, field thickness and density determinations of the bituminous mixture shall be made in lots, each lot representing one day's placement.

A lot shall be divided into 5 equal sublots, and 1 test shall be made for each sublot.

The location of the field tests may be chosen on a random basis using ASTM D3665, Section 4.3, except that any random location given shall be set back 2 feet from a curb or 3 feet from an edge, joint, or seam.

A summary of the random number chart used and the lot description shall be completed and approved by the Engineer or Owner prior to sampling and shall be included in the finished test results.

Determination of the field thickness of the compacted bituminous mixture, as required by the Engineer or Owner shall be accomplished by ASTM D3549, "Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens."

Determination of the field density of the compacted bituminous mixture shall be accomplished by either of the methods listed below. In case of dispute, ASTM D1188 as modified shall govern.

ASTM D2950, "Density of Bituminous Concrete in Place by Nuclear Method." When this method is used, the nuclear device shall first be correlated with the density of core samples.

ASTM D1188, Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens." When this method is used, the procedure shall be modified to require the use of "Coated Specimens" (Parafilm or Paraffin) only. The use of Bulk Specific Gravity determinations by SSD (surface saturated dry) method are prohibited.

The use of ASTM D2950 shall include correlation of test results to drilled cores.

A minimum of 1 lot (one full day's production), and not less than 5 sublots, shall be used for this correlation.

Should any nuclear test density in the first lot differ from its corresponding drilled core density by more than 3.00 percent relative compaction, a second lot shall be correlated and the average of all sublots in the first and second lots, but not less than 10 sublots, shall be used for the correlation. The 4-inch cores shall be transferred to the Engineer or Owner along with the random number generator listing station/offset locations.

The theoretical maximum density of the bituminous mixture shall be determined by taking random samples of the mixture delivered to the job-site and testing in accordance with ASTM D2041, "Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures."

At least 2 theoretical maximum density determinations shall be made for each day's production of bituminous mixture used in the work.

If the day's production is less than 500 tons, then only 1 theoretical maximum density determination is required.

As a quality control measure, the Contractor shall, at no cost to UNLV, make periodic checks on the field density of the compacted bituminous mixture at any time during paving operations. The testing performed by the Contractor may be used by the Engineer or Owner in part or in whole as the basis of acceptance in addition to the Quality Assurance testing to be done by the Engineer or Owner.

The pavement thickness acceptance criteria are as listed below:

If the average of all measurements meets or exceeds the design thickness, with no core more than 10 percent less than the design thickness, the placement is acceptable.

If there is only an isolated thin area, the limits of the area should be identified to determine if a construction resolution is necessary.

If the core results indicate a consistently thin section, with no core more than 15 percent less than the design thickness and the approval of the Engineer or Owner, the Contractor has the option of proposing a construction resolution or contributing an amount equivalent to the reduction in the asset value. Calculation of the lost asset value is accomplished with the following steps:

Determine the annual numbers of 18-kip equivalent single axle loads (ESAL), based upon the design traffic index (TI), a 20-year design life and an assumed traffic growth rate.

Calculate the composite structural number of the designed road section (i.e., the AC and aggregate base sections).

Using the average AC thickness, calculate the structural number of the constructed road section.

Determine the ESAL value that correlates with the reduced structural number.

Based upon the annual ESAL counts, determine the corresponding design life of the reduced section.

Using a 3 percent inflation factor and the unit cost of the AC (on a $/square yard basis) determine the equivalent uniform annual cost (EUAC) of each section.

Multiply the reduction in design life by the EUAC to determine the reduced value of the pavement, on a unit cost basis.

Multiply the unit cost by the pavement area.

If the core results yield an average thickness greater than the design thickness, but are alternately very high and very low (more than 10 percent out), the Engineer or Owner may reject the placement.

The pavement density acceptance criteria for production placements shall be as listed below, otherwise specified in the project plans or contract documents:

The average density for parking lots, parking lot aisles and campus entry roads shall be 92 percent +/2.0 percent (90.0 percent – 94.0 percent), with no single density deviating more than 4 percentage points (all measurements between 88 percent – 96 percent). If the average is between 2.0 percent – 4.0 percent out (88 percent – 90.0 percent or 94.0 – 96 percent), with no density more than 5.0 percent out (all measurements between 87 percent – 97 percent), the Contractor has the option of contributing the lost asset value of $1.22 per square yard per percentage point deviation from the acceptance range.

Maintaining Traffic

Traffic shall not be allowed on newly placed pavement for at least 24 hours or until the bituminous paving mix in-place temperature has dropped below 104 degrees F.

Exceptions shall be made at the discretion of the Engineer or Owner. Artificial means to reduce the pavement temperature may be used as approved by the Engineer or Owner.

Joints

Placing of the bituminous paving shall be as continuous as possible.

Rollers shall not pass over the unprotected end of the freshly laid mixture unless authorized by the Engineer or Owner.

Transverse joints shall be conformed by cutting back on the previous run to expose the full depth of the course.

A brush coat of asphalt emulsion shall be used on contact surface of transverse joints just before additional mixture is placed against the previously rolled material.

Longitudinal joints shall be spaced so that joints in succeeding courses will be at least 6 inches horizontally from joints in any preceding course. Lanes will be evened up each day to eliminate cold longitudinal joints insofar as practicable.

Transverse joints shall be spaced so that joints in succeeding courses will be a minimum of 5 feet horizontally from joints in any adjacent course. Lanes shall be evened up each day to eliminate cold transverse joints insofar as practicable.

Comply with Subsection 3.10, “Spreading and Finishing.”

Surface Tolerances

Surface tolerances will be specified under the respective section of bituminous pavement.

SECTION 02770

SITE CONCRETE WORK

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for Portland cement concrete pavement, cement walks, curbs, gutters, trash pick-up area, ramps, mowing strips, fence post footings, sliding gate concrete tracks, catch basins, pipe bedding and encasements, thrust blocks, transition structures, flagpoles and light standard bases and footings, athletic equipment footings and equipment pads.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Quality Assurance
Comply with Standard Specifications For Public Works Construction.

Submittals

Shop Drawings: Submit plans, elevations and details of concrete site Work.

Product Data: Submit mix designs and manufacturer’s technical data for materials and products. Submit 3” x 3” concrete Sample of each specified color.

For Decorative Concrete paving a minimum 8’ x 8’ sample of each type of decorative concrete paving, and/or color shall be provided for approval. These samples upon approval shall remain on site as a mock-up to establish level of finish required.

Material Sample: Submit one concrete bumper to the IOR for destructive testing.

Materials

Concrete, Mortar and Related Materials: Comply with applicable provisions of Standard Specifications for Public Works Construction, Section 201 - Concrete, Mortar and Related Materials:

Concrete: 28-day compressive strength 4,000 psi, unless specified otherwise. (REV 02)

Reinforcing Mesh: #4 rebar at 18” on center. (REV 02)

Expansion Joint Filler: Preformed expansion joint filler, bituminous type, complying with ASTM D 994.

Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, non-fading, and resistant to lime and other alkalis.

Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

Form Materials:

Side forms: Douglas fir, Construction Grade or Better or metal forms.

Stakes: Douglas fir, Construction Grade or Better or metal stakes.

Concrete Parking Bumpers:

Precast concrete, smooth and free of pits and rock pockets, providing a minimum 28-day compressive strength of 3,500 psi. Size at least 7-1/2 inches wide, 5-1/2 inches high and 6 feet long. Reinforce with 2 #5 reinforcing bars. Provide 2-3/4 inch diameter pre-drilled holes for anchor installation.

Bumper Anchors: Provide ½-inch diameter x 18-inch long galvanized steel pipe.

Bumper Adhesive: Provide adhesive recommended by bumper manufacturer/installer for fastening bumpers to concrete pavement.

Concrete sidewalks shall be at 4,500 psi and all Fire Lanes shall be at 6,000 psi with #4 rebar at 18" on center. (REV 02)

Installation Guidelines

Construction of Form for cast-in-Place Structures.

Concrete Pavement: Install Portland cement concrete pavement in compliance with the Standard Specifications for Public Works Construction, Section 302- Roadway Surfacing.

Miscellaneous Exposed Concrete: Install concrete curbs, walks, gutters, cross gutters, access ramps, driveways, catch basins, yard boxes, vaults and similar structures, in compliance with the Standard Specifications for Public Works Construction, Section 303 - Concrete and Masonry Construction.

Exposed Concrete Bases: Install bases, such as for post, flagpole, light standards and similar bases, in compliance with the Standard Specifications for Public Works Construction, Section 303 - Concrete and Masonry Construction.

Post, flagpole, light standard footings below grade, underground conduit bedding, encasements, thrust blocks and similar structures may be placed \directly in excavations conforming to the required sizes.

Reinforcement installation and concrete placement, surface finishes, curing and removal of forms shall be performed in compliance with applicable provisions of Standard Specifications for Public Works Construction, Section 303 - Concrete and Masonry Construction. Provide heavy broom finish at slopes exceeding six (6) percent and medium broom finish at slopes up to six (6) percent.

Installation of Parking Bumpers
Install bumpers as indicated on the Drawings. On bituminous paving, install anchors through pavement and into the ground a minimum of 12 inches. On concrete pavement, install bumpers in a continuous bed of adhesive.

Cleaning and Adjusting

Clean Up
Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

Protection
Protect the Work of this section until Substantial Completion.

SECTION 02780

UNIT PAVERS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for exterior unit pavers. This may include brick, stone and or pre-cast concrete pavers set in a paving bed.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Quality Assurance

Build mockups for each form and pattern of unit paver.

Retain below if mockups are erected as part of Project; otherwise, Division 1 requires that mockups be removed when directed.

Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

<u>Submittals</u>

Samples: Showing the full range of colors, textures, and patterns available for each type of unit paver indicated.

Include Samples of material for joints and accessories involving color selection.

Product Standards

Unit Pavers

Brick Pavers: Light-traffic paving brick; ASTM C 902, Class and type appropriate for application. Provide brick without frogs or cores in surfaces exposed to view in the completed Work.

Concrete Pavers: Solid, interlocking paving units, ASTM C 936, made from normal-weight aggregates in sizes and shapes indicated.

Rough-Stone Pavers: Rectangular tumbled paving stones, with split faces and edges, made from granite complying with ASTM C 615.

Asphalt-Block Pavers: Manufacturer's standard solid units consisting of coarse aggregate, inorganic dust as filler, and asphalt cement; in sizes and shapes indicated.

Accessories

Plastic Edge Restraints: Manufacturer's standard triangular PVC extrusions, 1-3/4 inches (45 mm) high by 3-1/2 inches (89 mm) wide; rigid type for straight edges and flexible type for curved edges, with pipe connectors and 3/8-inch (9.5-mm) diameter by 12-inch- (300-mm-) long steel spikes. Concrete edge shall be placed to hold pavers along with the Plastic Edge Restraint. (REV 02)

Sentence removed. (REV 02)

Sentence removed. (REV 02)

Cork Joint Filler: Preformed strips complying with ASTM D 1752, Type II.

Compressible Foam Filler: Preformed strips complying with ASTM D 1056, Grade 2A1.

Aggregate Setting-Bed Materials

Graded Aggregate for Base: Type II base at 95% compaction. (REV 02)

Geotextile: Woven or nonwoven polyester or polypropylene geotextile, with a permeability rating 10 times greater than that of subgrade soil and an apparent opening size small enough to prevent passage of fines from leveling course into base course.

Sand for Leveling Course: Sound, sharp, washed sand complying with gradation requirements of ASTM C 33 for fine aggregate.

Sand for Joints: Sharp, washed sand with 100 percent passing No. 16 (1.18-mm) sieve.

INSTALLATION GUIDELINES

Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

Cut unit pavers with motor-driven masonry saw to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible.

For concrete pavers, a block splitter may be used.

Tolerances: Do not exceed 1/16-inch (1.6-mm) unit-to-unit offset from flush nor 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) from level, or indicated slope.

Expansion and Control Joints: Provide joint filler as backing for sealant-filled joints where indicated. Install joint filler before setting pavers.

Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

Tamp bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set and disturb pavers for purposes of realigning finished surfaces or adjusting joints.

SECTION 02810

IRRIGATION SYSTEMS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

Furnish all labor, materials, supplies, equipment, tools, and transportation, and perform all operations in connection with and reasonably incidental to the complete installation of the irrigation system, and guarantee/warranty as shown on the drawings, the installation details, and as specified herein. Work should be designed by a licensed landscape architect and installed by a licensed landscape contractor. (REV 02) Items of work specifically included are:

Procurement of all applicable licenses, permits, and fees.

Coordination of Utility Locations – Notify "Call Before You Dig" and UNLV Planning and Construction.

Connection of electrical power supply to the irrigation control system. Connection of designated telephone line and phone number for central control. (REV 02)

Connection of irrigation control system to the master irrigation control system

Sleeving for irrigation pipe and wire.

Installation of pump station for irrigation system. Pump to be enclosed and secured. Feed and supply lines from pump to be copper. If the pump is installed in concrete, copper must be sealed in a plastic and isolation material shall surround line to prevent damage from the contraction of concrete. (REV 02)

Maintenance period.

Work Not Included

Items of work specifically excluded or covered under other sections are:

Provision of electrical power supply for irrigation control system.

Related Work

Division 2: Site Work

I. Section 02920 - Fine Grading and Soil Preparation

II. Section 02931 - Seeding

III. Section 02932 - Sodding

IV. Section 02950 - Trees, Plants and Ground Cover

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Rules and Regulations

Work and materials shall be in accordance with the latest edition of the National Electric Code, the Uniform Plumbing Code as published by the Western Plumbing Officials Association, and applicable laws and regulations of the governing authorities.

When the contract documents call for materials or construction of a better quality or larger size than required by the above-mentioned rules and regulations, provide the quality and size required by the contract documents.

If quantities are provided either in specifications or on these drawings, these quantities are provided for information only. It is the contractor's responsibility to determine the actual quantities of all material, equipment, and supplies required by the project and to complete an independent estimate of quantities and wastage.

Reviews
The purpose of on-site reviews by the Owner's Representative is to observe the Contractor's interpretation of the construction documents and to address questions with regards to the installation.

Scheduled reviews such as those for irrigation system layout are to be scheduled with the Owner's Representative as required by these specifications.

Impromptu reviews may occur at any time during the project.

Final review will occur at the completion of the irrigation system installation and submittal of Record (As-Built) Drawings.

Project Record (As-Built) Drawings

Maintain on-site and separate from documents used for construction, one complete set of contract documents as Project Documents. Keep documents current. Do not permanently cover work until as-built information is recorded.

Record pipe and wiring network alterations. Record work which is installed differently than shown on the construction drawings. Record accurate reference dimensions, measured from at least two permanent reference points, of each irrigation system valve, each backflow prevention device, each controller or control unit, each sleeve end, each stub-out for future pipe or wiring connections, and other irrigation components enclosed within a valve box. Locate buried components by dimension above grade features.

Prior to Final Acceptance, submit a red-lined mark-up of as-built conditions to architect/engineer. Label each sheet "Record Drawing". Completion of the Record Drawings will be a prerequisite for the Final Review.

Maintenance

Upon completion of Final Review, maintain irrigation system for a duration of 90 calendar days. Make periodic examinations and adjustments to irrigation system components so as to achieve the most desirable application of water.

Following completion of the Contractor's maintenance period, the Owner will be responsible for maintaining the system in working order during the remainder of the guarantee/warranty period, for performing necessary minor maintenance, for trimming around sprinklers, for protecting against vandalism, and for preventing damage after the landscape maintenance operation.

Cleanup

Upon completion of work, remove from the site all machinery, tools, excess materials, and rubbish.

SUBMITTALS

Submittals
Submittals shall be in conformance with section 01330- Submittal Procedures.

Materials List
Include pipe, fittings, mainline components, water emission components, control system components. Quantities of materials need not be included.

Manufacturers' Data
Submit manufacturers' catalog cuts, specifications, and operating instructions for equipment shown on the materials list.

Shop Drawings
Submit shop drawings called for in the installation details. Show products required for proper installation, their relative locations, and critical dimensions. Note modifications to the installation detail.

MATERIALS

Quality
Materials used in the system shall be new and without flaws or defects of any type, and shall be the best of their class and kind.

Substitutions
Pipe sizes referenced in the construction documents are minimum sizes, and may be increased at the option of the Contractor.

Sleeving

Install separate sleeve beneath paved areas to route each run of irrigation pipe or wiring bundle.

Sleeving material beneath pedestrian pavements shall be PVC Schedule 40 pipe with solvent welded joints.

Sleeving beneath drives and streets shall be PVC Schedule 40 pipe with solvent welded joints.

Sleeving diameter: equal to twice that of the pipe or wiring bundle.

Pipe and Fittings

Mainline Pipe and Fittings

Use Schedule 40 conforming to the dimensions and tolerances established by ASTM Standard D1785.

Use rubber-gasketed pipe for mainline pipe with a nominal diameter greater than or equal to 3-inches. Use rubber-gasketed PVC, ductile iron, or epoxy-coated steel fittings with lubricant approved by the pipe manufacturer. Use PVC gasketed fittings which are manufactured in one piece of injection molded PVC compound meeting ASTM D1784 and are rated Schedule 40. Use ductile iron fittings conforming to ASTM C153. Use gasketed pipe equipped with Reiber Gasket System. Pipe fittings may use standard gaskets.

III. Use solvent weld pipe for mainline pipe with a nominal diameter of less than 3-inches or where a pipe connection occurs in a sleeve. Use Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784. Use primer approved by the pipe manufacturer. Solvent cement to conform to ASTM Standard D2564, CHANGE TO : Utilizing Weld-on P-70 Primer with Weld-on 721 PVC Plastic pipe Cement on all glued PVC fittings on system. (Robert lynn to answer my question)

Lateral Pipe and Fittings

I. Use Schedule 40, SDR-21, rated at 200 PSI, conforming to the dimensions and tolerances established by ASTM Standard 2241. Fittings for PVC pipe shall be Schedule 40, Type 1, PVC solvent weld fittings, ASTM Standards D2466 and D1784.

II. *Use primer approved by the pipe manufacturer. Solvent cement to conform to ASTM Standard D2564, of a type approved by the pipe manufacturer.*

III. Drip Lateral Pipe downstream of Zone Control Valves

i. Use flexible, algae resistant, PVC hose extruded from integrally algae resistant PVC compound conforming to ASTM D2287.

ii. Fittings shall be Schedule 40, Type 1, PVC solvent weld fittings compatible with the PVC hose. Use tubing stakes to all hold above-ground pipe in place even if covered by mulch materials.

Specialized Pipe and Fittings

Copper pipe

I. Type "K" rigid conforming to ASTM Standard B88. All Copper pipe to be buried shall be wrapped to avoid corrosion.

II. Fittings shall be wrought copper or cast bronze, soldered or threaded per the installation details. Solder shall be 95% tin and 5% antimony.

Use a dielectric union wherever a copper-based metal (copper, brass, bronze) is joined to an iron-based metal (iron, galvanized steel, stainless steel).

Use pipe specifically intended for use as a flexible swing joint. (REV 02)

i. Inside diameter: 0.490+0.010 inch.

ii. Wall thickness: 0.100+0.010 inch.

iii. Color: Black.

II. Use 3/8" Salco with glued fittings with the same thickness (REV 02) as the hose.

Assemblies calling for threaded pipe connections shall utilize PVC Schedule 80 nipples and PVC Schedule 40 threaded fittings.

Joint sealant
Use only Teflon-type tape pipe joint sealant on plastic threads. Use non-hardening nontoxic pipe joint sealant formulated for use on water-carrying pipes on metal threaded connections.

Thrust Blocks

Use thrust blocks for fittings on pipe greater than or equal to 3-inch diameter or any diameter rubber gasketed pipe.

Use 3,000 PSI concrete.

Mainline Components

Main System Shutoff Valve
As per local practice and in compliance with local code. Must be all brass Nepco with hexnut for shut off.

Backflow Prevention Assembly
Installation of a Master Valve prior to all zones. This is to include the installation of flow sensors connected to provide data to the flow meter mentioned in section 7c. (REV 02) as presented in the installation details.

Flow Meter Assembly
As presented in the installation details.

Isolation Gate Valve Assembly
As presented in the installation details. Install a separate valve box over a 3-inch depth of 3/4-inch gravel for each assembly.

Quick Coupling Valve Assembly
Double swing joint as presented in the installation details. Install shut off ball valve prior to Quick coupler. (REV 02)

Sprinkler and Bubbler Irrigation Components

Remote Control Valve (RCV) Assembly for Sprinkler and Bubbler Laterals
As presented in the installation details. Use wire connectors and waterproofing sealant to join control wires to solenoid valves (specifically, Rain Bird PEB valves). Install a separate valve box over a 3-inch depth of 3/4-inch gravel for each assembly. Also, valve box must be branded for identification.

Sprinkler Assembly
As presented in the drawings and installation details.

Bubbler Assembly
As presented in the drawings and installation details.

Drip Irrigation Components

Remote Control Valve (RCV) Assembly for Drip Laterals
As presented in the installation details. Use wire connectors and waterproofing sealant to join control wires to solenoid valves. Install a separate valve box over a 3-inch depth of 3/4-inch gravel for each assembly. Remote control to have designated 30-40 psi pressure regulators with Y filter. (REV 02)

Zone Control Valve Assembly
As presented in the installation details. Install a separate box over a 3-inch depth of 3/4-inch gravel for each assembly.

Drip Emitter Assembly

I. Glued fittings and pressure compensating emitter device as presented in the installation details.

II. Install Bowsmith emitter types and quantities on the following schedule:

i. Ground cover plant
1 single outlet emitter each or 1 single outlet emitter per square foot of planting area, whichever is less

ii. Shrub
2 single outlet emitters each

iii. Tree
Nififim or soaker line to start 10 inches off the base of the trunk to extend to 12 to 18 inches intervals to reach mature tree canopy. Intervals dependent upon specifications of the drip line. (REV 02)

III. Length of emitter outlet tubing shall not exceed five feet. Secure emitter outlet tubing with tubing stakes. (REV 02)

IV. Sentence removed. (REV 02)

Flush Cap Assembly
As presented in the installation details, locate at the end of each drip irrigation lateral pipe. Install a separate valve box over a 3-inch depth of 3/4-inch gravel for each assembly.

Control System Components rrigation Control Units

I. Satellite control unit
Rain Bird ESP Site SAT, Stainless Steel. All satellite controllers to be compatible with existing central control system.

II. Wire markers
Pre-numbered or labeled with Indelible non-fading ink, made of permanent, non-fading material.

III. Lightning protection
As recommended by the control system manufacturer.

IV. Primary surge protection arrestors
Model LPP-K, manufactured by Rain Bird Sprinkler Manufacturing Corporation, Glendora, California.

V. Valve output surge protection arrestors
Model LPV-K, manufactured by Rain Bird Sprinkler Manufacturing Corporation, Glendora, California.

Signal Wire

I. Electrical wire from the central control unit to the satellite control units shall be double jacketed, four (4) conductor cable ___, as recommended by the control unit manufacturer.

II. Splices
Use 3M Series 3500 Scotch-Lok connector pack 3M 82A connector pack ___. All splices must be in junction box (no buried splicer).

III. Warning tape
Inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. Three inches wide, colored yellow, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."

Control Wire

I. Electric wire from the satellite control unit to each remote control valve shall be American Wire Gauge (AWG) No. 14 (minimum) solid copper, Type UF cable, UL approved for direct underground burial.

II. Color
Wire color shall be continuous over its entire length. Use white for common ground wire. Use easily distinguished colors for other control wires. Spare control wires shall be of a color different from that of the active control wire.

III. Splices
Use wire connector with waterproof sealant. Wire connector to be of plastic construction consisting of two (2) pieces, one piece which snap locks into the other. A copper crimp sleeve to be provided with connector.

IV. Warning tape
Inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils.
Three inches wide, colored yellow, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."

Existing Control Wire
It is assumed that existing 24 VAC control wire between existing independent controllers and solenoid valves is in workable condition. Any concerns or problems identified prior to or during the installation of the replacement satellite controller, are to be brought to the attention of the owner's Representative.
Other Components: Tools and Spare Parts
Provide operating keys, servicing tools, test equipment, other items, and spare parts indicated in the General Notes of the drawings.

QUALITY CONTROL TESTING

Notify the Owner's Representative three days in advance of testing.

Pipelines jointed with rubber gaskets or threaded connections may be subjected to a pressure test at any time after partial completion of backfill. Pipelines jointed with solvent-welded PVC joints shall be allowed to cure at least 24 hours before testing.

Subsections of mainline pipe may be tested independently, subject to the review of the Owner's Representative.

Furnish clean, clear water, pumps, labor, fittings, and equipment necessary to conduct tests or retests.

HYDROSTATIC PRESSURE TEST

Cap risers for hydrostatic pressure tests. Backfill to prevent pipe from moving under pressure. Expose couplings and fittings.

Subject mainline and lateral pipe to a hydrostatic pressure equal to the anticipated operating pressure for two hours. Leakage will be detected by visual inspection. Replace defective pipe, fitting, joint, valve, or appurtenance. Repeat the test until the pipe passes test.

Cement or caulking to seal leaks is prohibited.

COVERAGE TEST

Activate each remote control valve in sequence. The Owner's Representative will visually observe water application patterns.

Adjust or move system components to correct coverage deficiencies. Repeat the test until the system passes test.

SIGNAL WIRE

Test for leaks to ground per manufacturer's recommendations. Test results must meet or exceed manufacturer's guidelines for acceptance.

Replace defective wire, underground splices, or appurtenances. Repeat the test until the manufacturer's guidelines are met.

INSTALLATION GUIDELINES

Inspection and Reviews

Site Inspections

Verify site conditions and note irregularities affecting work of this section. Report irregularities to the Owner's Representative prior to beginning work.

Beginning work of this section implies acceptance of existing conditions.

Irrigation System Layout Review
Irrigation system layout review will occur after the layout has been completed. Notify the Owner's Representative two days in advance of review. Modifications will be identified by the Owner's Representative at this review.

Utility Locates ("Call Before You Dig")

I. Arrange for and coordinate with University personnel the location of all underground utilities.

III. Repair any underground utilities damaged during construction which were properly located prior to construction. Make repairs at no additional cost to the contract price.

LAYOUT OF WORK

Stake out the irrigation system. Items staked include: sprinklers, pipe, control valves, pump station, satellite controllers, isolation valves, master valve, and flow sensor. (REV 02)

Excavation, Trenching, and Backfilling

Excavate to permit the pipes to be laid at the intended elevations and to permit work space for installing connections and fittings.

Minimum cover (distance from top of pipe or control wire to finish grade):

I. 30-inch over mainline pipe 6-inch and larger.

II. 24-inch over mainline pipe 4-inch and smaller.

III. 24-inch over control wire and electrical conduit.

IV. 24-inch over signal wire.

V. 12 to 18-inches over lateral pipe to sprinklers and bubblers and drip manifold pipe to drip system zone control valves.

VI. 8-inch over drip lateral pipe in turf or paved areas downstream of drip system zone control valves.

VII. 3-inch minimum mulch cover over drip lateral pipe in planting beds downstream of drip system zone control valves.

Minimum burial depths equals minimum cover listed above. (REV 02)

Backfill only after lines have been reviewed and tested.

Use "washed plaster sand" for bedding around mainline pipe. Install a minimum 2-inch thickness of bedding around the mainline pipe.

Excavated material is generally satisfactory for backfill above mainline pipe bedding and lateral piping. Backfill shall be free from rubbish, vegetable matter, and stones larger than 2-inches in maximum dimension. Remove material not suitable for backfill. Backfill placed next to lateral pipe shall be free of sharp objects which may damage the pipe.

Backfill unsleeved pipe in either of the following manners:
Backfill and puddle the lower half of the trench. Allow to dry 24 hours. Backfill the remainder of the trench in 6-inch layers. Compact to density of surrounding soil.

II. Backfill the trench by depositing the backfill material equally on both sides of the pipe in 6-inch layers and compacting to the density of surrounding soil.

Enclose pipe and wiring beneath roadways, walks, curbs, etc., in sleeves. Minimum compaction of backfill for sleeves shall be 95% Standard Proctor Density, ASTM D698-78 or as required by Clark County
Regulations for roadway crossings. Conduct one compaction test for each sleeved crossing less than 50 feet long. Conduct two compaction tests for each sleeved crossing greater than 50 feet long. Costs for such testing and any necessary retesting shall be borne by the Contractor. Use of water for compaction around sleeves, "puddling", will not be permitted.

Dress backfilled areas to original grade. Dispose of excess backfill off site.

Where utilities conflict with irrigation trenching and pipe work, contact the Owner's Representative for trench depth adjustments.

SLEEVING AND BORING

Install sleeving at a depth which permits the encased pipe or wiring to remain at the specified burial depth.

Extend sleeve ends six inches beyond the edge of the paved surface. Cover pipe ends and mark with stakes. Mark concrete with a chiseled "x" at sleeve end locations.

Bore for sleeves under obstructions which cannot be removed. Employ equipment and methods designed for horizontal boring.

ASSEMBLIES AND PIPE FITTINGS

General

I. Keep pipe free from dirt and pipe scale. Cut pipe ends square and debur. Clean pipe ends.

II. Keep ends of assembled pipe capped. Remove caps only when necessary to continue assembly.

Mainline Pipe and Fittings

I. Sentence removed. (REV 02)

II. PVC Rubber-Gasketed Pipe

i. Use pipe lubricant. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.

ii. Epoxy-coated steel fittings shall not be struck with a metallic tool. Cushion blows with a wood block or similar shock absorber.

III. PVC Solvent Weld Pipe

i. *Use primer and solvent cement. Join pipe in a manner recommended by the manufacturer and in accordance with accepted industry practices.*

ii. Cure for 30 minutes before handling and 24 hours before allowing water in pipe.

iii. Snake pipe from side to side within the trench.

Lateral Pipe and Fittings

I. Sentence removed. (REV 02)

II. PVC Solvent Weld Pipe

i. *Use primer and solvent cement. Join pipe in the manner recommended by the manufacturer and in accordance with accepted industry practices.*

ii. Cure for 30 minutes before handling and 24 hours before allowing water in the pipe.

iii. Snake pipe from side to side within the trench.

III. Drip Lateral Pipe downstream of Zone Control Valves

i. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.

ii. Snake pipe from side to side within the trench or on the soil surface. On the soil surface, hold pipe in place with tubing stakes spaced every five feet.

Specialized Pipe and Fitting

I. Copper Pipe

i. All buried copper piping shall be wrapped.

ii. Buff surfaces to be joined to a bright finish. Coat with solder flux.

iii. Solder so that a continuous bead shows around the joint circumference.

II. Insert a dielectric union wherever a copper-based metal (copper, brass, bronze) and an iron-based metal (iron, galvanized steel, stainless steel) are joined.

III. Section removed (REV 02)

IV. PVC Threaded Connections

i. Use only factory-formed threads. Field cut threads are not permitted.

ii. Use only Teflon-type tape.

iii. When connection is plastic-to-metal, the plastic component shall have male threads and the metal component shall have female threads.

V. Make metal-to-metal, threaded connections with Teflon-type tape or pipe joint compound applied to the male threads only.

Thrust Blocks

I. Use cast-in-place concrete bearing against undisturbed soil.

II. Size, orientation and placement shall be as shown on the installation details.

Installation of Mainline components

Main System Shut Off Valve
Install where indicated on the drawings.

Backflow Prevention Assembly
Install where indicated on the drawings. Install assembly so that its elevation, orientation, access, and drainage conform to the manufacturer's recommendations and applicable health codes.

Flow Meter Assembly
Install where indicated on the drawings.

Master valve and flow sensor (REV 02)

Isolation Gate Valve Assembly

I. Install where indicated on the drawings.

IV. Locate at least 12-inches from and align with adjacent walls or edges of paved areas.

Quick Coupling Valve Assembly
Install where indication on the drawings. Shut off ball valve prior to quick coupler. Quick coupler shall be placed every 200 feet along the main line. (REV 02)

Installation of Sprinkler and Bubbler Irrigation Components

Remote Control Valve (RCV) Assembly for Sprinkler and Bubbler Laterals

I. Flush mainline before installation of RCV assembly.

II. Install where indicated on the drawings. Wire connectors and waterproof sealant shall be used to connect control wires to remote control valve wires. Install connectors and sealant per the manufacturer's recommendations.

III. Install only one RCV to a valve box. Locate valve box at least 12-inches from and align with nearby walls or edges of paved areas. Install shut off ball valve prior to RCV valve. (REV 02) Group RCV assemblies together where practical. Arrange grouped valve boxes in neat, rectangular patterns. Allow at least 12-inches between valve boxes.

IV. System shall be designed so as RCV valve can accommodate without the need for adjustment. (REV 02)

Sprinkler Assembly

I. Flush lateral pipe before installing sprinkler assembly.

II. Install per the installation details at locations shown on the drawings.

III. Locate rotary sprinklers 12-inches from adjacent walls, fences, or edges of paved areas.

IV. Locate spray sprinklers 3-inches from adjacent walls, fences, or edges of paved areas.

V. Set sprinkler perpendicular to the finish grade with the use of swing joint. System line size shall be sized to accommodate the total flow and pressure requirement for the entire system to include RCV valves. All threaded connections shall utilize Teflon tape. Irrigation main line to be sized to accommodate two spray systems operating at the same time. (REV 02)

VI. Supply appropriate nozzle or adjust arc of coverage of each sprinkler for best performance.

VII. Adjust the radius of throw of each sprinkler for best performance.

Bubbler Assembly

I. Install bubbler assembly per the installation details at locations shown on the drawings.

II. Adjust the output flow of each bubbler for best performance.

Installation of Drip Irrigation Components

Remote Control Valve (RCV) Assembly for Drip Laterals

I. Flush mainline pipe before installing RCV assembly.

II. Locate as shown on the drawings. Wire connectors and waterproof sealant shall be used to connect control wires to remote control valve wires. Connectors and sealant shall be installed as per the manufacturer's recommendations.

III. Install only one RCV to valve box. Locate at least 12-inches from and align with nearby walls or edges of paved areas. Group RCV assemblies together where practical. Allow at least 12-inches between valve boxes.

IV. Arrange grouped valve boxes in rectangular patterns. Installation of 30 psi pressure regulator and Y-filter to be installed (pressure setting for regulator determined by landscape architect) (REV 02)

Zone Control Valve Assembly
Install at locations shown on the drawings.

Drip Emitter Assembly

I. Locate as shown on the drawings and installation details.

II. Flush lateral pipe before installing emitter assembly.

III. Cut emitter outlet distribution tubing square.

IV. Sentence removed. (REV 02)

V. All drip line is to be a minimum of 3/8 inch algae resistant rubber Rubber hose (Selco). All fittings are to be glued using Weld-On 721 pipe cement. (REV 02)

Flush Cap Assembly
Install at the end of each drip irrigation lateral pipe as shown on the installation details.

Pressure Adjustment Procedure

I. Fully open all zone control valves and energize the RCV assembly.

II. Determine which emitter has the least outlet pressure; this is the critical emitter.

III. Identify zone control valve associated with the critical emitter; this is the critical zone control valve.

IV. Set discharge pressure of RCV such that the critical emitter has a pressure of 30 PSI + 2 PSI.

V. Identify the critical emitter for remaining zone control valves.

VI. Set each zone control valve such that its critical emitter has a pressure of 30 PSI + 2 PSI.

Installation of Control System Components

Irrigation Control Units

I. The locations of the control units as depicted on the drawings are approximate; the Owner's Representative will determine their exact site locations during sprinkler layout review.

II. Install electrical connections between central control unit components and satellite control units per manufacturer's recommendations.

III. Lightning protection: Install per manufacturer's recommendations.

IV. Install primary surge protection arrestors on incoming power lines.

V. Install one valve output surge protection arrestor on each control wire and one for the common wire.

VI. Attach wire markers to the ends of control wires inside the controller unit housing. Label wires with the identification number (see drawings) of the remote control valve to which the control wire is connected.

VII. Connect control wire or signal wire to the corresponding control unit terminal.

VIII Supply telephone line with designated phone number for central control. (REV 02)

Signal Wires

I. Route signal wire as directed on plans. Install with a minimum number of field splices.

II. All signal wire shall be laid in trenches. The use of a vibratory plow is not permitted.

III. Carefully backfill around signal wire to avoid damage to wire insulation or wire connectors.

IV. If a signal wire must be spliced, make splice with recommended connector, installed per manufacturer's recommendations. Locate all splices in a separate 6-inch round valve box. Coil 2 feet of signal wire in valve box.

V. Unless noted on plans, install wire parallel with and under PVC mainline pipe.

VI. Protect wire not installed with PVC mainline pipe with a continuous run of warning tape placed in the backfill six inches above the wiring.

Control Wire

I. Bundle control wires where two or more are in the same trench. Bundle with pipe wrapping tape spaced at 10-foot intervals.

II. Control wiring may be pulled into the soil utilizing a vibratory plow device specifically manufactured for pipe pulling. Minimum burial depth equals minimum cover previously listed.

III. Provide a 24-inch excess length of wire in an 8-inch diameter loop at each 90 degree change of direction, at both ends of sleeves, and at 100-foot intervals along continuous runs of wiring. Do not tie wiring loop. Coil 24-inch length of wire within each remote control valve box.

IV. Install common ground wire and one control wire for each remote control valve. Multiple valves on a single control wire are not permitted. Install spare control wires so at least two (2) wires pass each Remote Control Valve Assembly.

V. If a control wire must be spliced, make splice with wire connectors and waterproof sealant, installed per the manufacturer's instructions. Locate splice in a valve box which contains an irrigation valve assembly, or in a separate 10-inch round valve box. (Use same procedure for connection to valves as for in-line splices.)

VI. Unless noted on plans, install wire parallel with and under PVC mainline pipe.

VII. Protect wire not installed with PVC mainline pipe with a continuous run of warning tape placed in the backfill six inches above the wiring.

Installation of Other Components

Tools and Spare Parts

I. Prior to the Pre-Maintenance Review, supply to the Owner operating keys, servicing tools, test equipment, and any other items indicated on the drawings.

II. Prior to Final Review, supply to the Owner the spare parts indicated in the General Notes on the drawings.

Other Materials
Install other materials or equipment shown on the drawings or installation details to be part of the irrigation system, even though such items may not have been referenced in these specifications.

Warranty

The purpose of this guarantee/warranty is to insure that the Owner receives irrigation materials of prime quality, installed and maintained in a thorough and careful manner.

For a period of one year from commencement of the formal maintenance period, guarantee/warranty irrigation materials, equipment, and workmanship against defects. Fill and repair depressions. Restore landscape or structural features damaged by the settlement of irrigation trenches or excavations. Repair damage to the premises caused by a defective item. Make repairs within 48 hours (REV 02) of notification from the Owner's Representative.

Contract documents govern replacements identically as with new work. Make replacements at no additional cost to the contract price.

Guarantee/warranty applies to originally installed materials and equipment and replacements made during the guarantee/warranty period.

SECTION 02870

SITE FURNISHINGS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for site furnishings and accessories.

System Design and Performance Requirements

Benches, tables, bollards, bicycle racks receptacles, if appropriate to the facility, shall be included in the project. All site furnishings shall meet the UNLV Master Plan Guidelines,
unless specified otherwise.

Generally these items shall be anchored in concrete so as not to be removed by vandals. Specify items which can be readily replaced if damaged.

PRODUCTS

Benches: Dura Art Stone and Gametime "Ultrim" UF-3000. Concrete and perforated metals are preferred to wood and fiberglass

Trash Receptacles: Form Products, 7-WCF-ATL. Do not locate on or above paved surfaces.

Bicycle parking racks: Per UNLV Master Plan Guidelines.

Tree Grates: Neenah, Urban Accessories, Canterbury International. To be installed with frames.

Drinking Fountains: Haws. Must be handicapped accessible

Public and Emergency (blue light) telephones. Must be handicapped (ADA) accessible. Emergency telephone shall be hands free operation by Talk-A-Phone, Model 400 - cfr Mushroom. Blue light fixture shall be combination type for both blue light and strobe operation.

Building ID Signs. Per Division 10
Use schedule below as a guide only. See suggested procedures in "Writing Guide" Article in the Evaluations in Division 9 Section "Painting" for guidance before editing schedule.

SECTION 02900

TREES, SHRUBS AND GROUND COVERS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for trees, shrubs, ground covers and other new plantings.

System Design and Performance Requirements

Designers are encouraged to use plant material in energy conserving, climate ameliorating ways. Combinations of deciduous and evergreen shade trees can do much to mediate weather and climatic extremes.

Designers shall refer to site paving drawings and coordinate size of plant pits so as to not undermine hardscape.

Plant materials shall be selected from the most current revision of the UNLV Landscape Guidelines.

Water harvesting measures should be considered where available.

PRODUCT STANDARDS

Imported topsoil shall be natural, friable loam. Submit written evidence of tests for pH and total dissolved salts (TDS) prior to delivery. pH shall be between 6.5 and 8.0, TDS shall not exceed 1000 parts/million.

Mulch shall be "Forest Magic" brand or other approved nitrogen stabilized (nitrolized) fine ground fir bark for planting purposes. If mulch is not used for planting purposes then it can be any material used to help retain moisture. Crushed granite can be considered as mulch and stone from 3/8 inch up to 4 inches. Color to be determined by the Landscape Architect with UNLV approval. (REV 02)

Fertilizer shall be commercial Ammonium Phosphate w/an NPK ration of 16-20-0; use Agriform 20-10-5 formula, 21 gram tablets for salvaged and replanted plants.

Soil sulphur shall be agricultural grade, pilled or granulated, containing 99.5% active and 0.5% inert ingredients.

Manure shall be composted, well rotted, free of refuse and containing not more than 25% straw or other bedding material.

Soil mix for backfilling shall be three parts topsoil to one part mulch with one pound Ammonium Phosphate and two pounds soil sulphur added per cubic yard. Consideration should be given to the type of plant being utilized and the current PH of the soil. The decision to add Ammonium Phosphate and

Sulphur should be made by the Landscape Architect. Some plant survive at a 6.5-6.8 ph, however plants from the southwest are used to a higher ph which may not be necessary to add Sulphur or Ammonium Phosphate. (REV 02)

Tree stakes shall be three (3) inch diameter by eight (8) feet long, pressure-treated Lodgepole Pine, free of any weakening knots or other defect. Stake trees up to 15 gallon size with two (2) stakes. Larger sizes shall be staked or guyed.

Guy wire shall be new, 12 gauge, annealed, galvanized.

Chafing guards shall be new, 3/4" dia. reinforced rubber or vinyl hose, 12" long (min) or as necessary to protect tree from guy wires.

Pre-emergent herbicide shall be “Surflan” or approved equal.

Palm tying twine shall be natural fiber.

INSTALLATION GUIDELINES

New and existing utilities shall not conflict with planting.

Where plant material will be placed in soil beneath existing pavement, especially asphalt pavement, or other condition where soil sterilant or other treatment potentially harmful to plant material may have been applied shall be tested for the presence of any such chemicals or condition. Affected soils shall be treated and/or excavated and disposed of in accordance with local codes.

Minimum planting pit sizes shall be as follows:

One (1) gallon size container: 18" in dia.

Five (5) gallon size container: 36" in dia.

Fifteen (15) gallon size container: 60" in dia.

Twenty four (24") inch box. 60" square.

Thirty six (36") inch box and larger. 18" clear on all sides.

Depth of all pits no deeper than the rootball to prevent settling.

Plant pits shall not undermine hardscape nor shall hardscape elements be placed over plant pits.

Areas to receive ground cover plants shall be excavated in their entirety to 18" below finish grade and backfilled with backfill mix described above.

Planting pit percolation rates to be determined prior to planting in the presence of UNLV representative.

After water settling backfill, set plants lower than finish grade to create irrigation basins such that the crown of the root ball shall be 4" lower than surrounding finish grade. Basins shall be as wide as the plant pit. Top of rootball shall be flush with finish grade of the basin.

2" of mulch shall be incorporated into the top 3" of soil in irrigation basin areas.

Root balls of existing palm trees to be transplanted shall have a minimum diameter of 4 feet plus the diameter of the trunk measure 12" above the ground. Vitamin B-1 shall be used per manufacturer's recommendations with the first watering.

Salvage of existing trees from the project shall be performed by a firm approved by the University and with at least four years experience with this type of work. The work shall be guaranteed and conduced in a manner consistent with local practice. The University shall designate a holding area and source of irrigation for boxed or other wise temporarily stored trees.

The landscape contractor shall maintain all planting until accepted. Maintenance operations shall include: watering, mulching, tightening or adjusting of tree ties, resetting plants to proper grade, restoration of irrigation basins, fertilization and weeding. Replacement materials shall meet all specifications of original materials.

Palm ties, not broken naturally, shall be cut by contractor after 4 months.

All plant materials shall be guaranteed for 1 full year following substantial completion or replacement.

SECTION 02940

LAWNS AND GRASSES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for lawns and grass sodding. New lawn Grass sodding and or seeding is currently prohibited at UNLV as an integral part of saving resources. The following spec shall be considered for patching of existing lawns scheduled to remain.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

QUALITY ASSURANCE

Contractor Qualifications: All work specified herein shall be performed by a licensed landscape contractor experienced with the type and scale of work required and having equipment and personnel adequate to perform the work satisfactorily, and having all applicable insurance, licenses, and permits to legally perform that work.

Contractor shall have on the site at all times a representative capable of reading and interpreting drawings and specifications.

Reference Standards: American Sod Producers Association Inc. (ASPA) Publication: Guideline Specifications for Sodding (updated).

SOURCE QUALITY CONTROL:

Compliance with Laws: All plant materials shall comply with State and Federal Laws with respect to inspection for disease infestation.

Analysis and Standards: All packaged standard products shall have manufacturer's certified analysis. For other materials, provide analysis if required in these specifications. Analysis is to be by a recognized laboratory and made in accordance with methods established by the Association of Official Agricultural Chemists.

Site Investigation and Protection
Contractor shall locate and protect existing adjoining pavement, curbing, structures, electric cables or conduits, irrigation and utility lines, existing plant materials, and other existing features or conditions above or below ground level that might be damaged as a result of his operations.

SOD

Provide strongly rooted sod, not less than two years old, free of weeds and undesirable grasses and machine cut to pad thickness of 3/4" (+/- 1/4"), excluding top growth and thatch. Provide only sod capable of vigorous growth and development when planted. Sod grass shall be viable and not dormant at time of installation.

Provide sod of uniform pad sizes with maximum 5% deviation in either length or width. Broken pads or pads with uneven ends will not be acceptable. Sod pads incapable of supporting their own weight when suspended vertically with a firm grasp on upper 10% of pad will be rejected. Sod pads shall be no less than 12 inches wide and three (3) feet long. Sod shall be a good healthy color when delivered and planted free of dry or decayed spots.

Mixture or type of sod shall be as noted on the Drawings or to match existing sod blend, in renovation situations or for replacement of damaged sod.

APPROVAL OF SUBGRADES

The Contractor is to inspect the subgrade prior to beginning preparation for sod. If the subgrade does not meet required rough grades or has conditions deleterious to sod growth, including but not limited to soil contaminants, debris, large rocks, etc., the Contractor shall notify the Architect in writing and receive directions from the Architect.

SUBMITTALS

Product Data:

Submit name of sod supplier for approval by the Architect prior to ordering sod.

Submit two copies of product names, literature and application rates for amendments and miscellaneous materials used for sodding including, but not limited to, fertilizer and soil amendments. Soil amendments and rates to be determined based on results of soil analysis.

INSTALLATION GUIDELINES

Preparation

Preparation of Subgrade: Before subgrade preparation, clean existing soil of roots, plants, sod, stones, clay lumps and other extraneous materials harmful or toxic to plant growth.

Preparation for Sodding:

Subgrade: All areas prepared for sod shall be brought to an even grade and shaped to drain. Set subgrades to allow for amendments such that the required finish grades will be met when completed. Areas to be sodded shall be uniformly compacted to prevent uneven settlement after sod installation.

Apply half of the amendments and thoroughly rototill them into the soil to a minimum depth of 12”. Rototill in two directions each at right angles to each other. Drag to even grade, and compact to (90) percent-modified proctor.

Rake and remove stones over 1" in any dimension, sticks, roots, rubbish and other extraneous matter brought to surface by the soil amendment process.

Water: Water area to be sodded thoroughly. Apply a minimum of two inches of water throughout area. Allow area to dry.

Regrade as necessary to insure drainage and to meet proposed grades. Correct any differential settlement as required.

Fine Grading:

Fine grade after fertilizing to smooth, even surface with loose, uniformly fine texture. Roll, rake and drag area, remove ridges, repair erosion and fill depressions as required to meet finish grades. Limit fine grading to areas which can be sodded within 24 hours after grading. Remove stones over 1" in any dimension, sticks, roots, rubbish and other extraneous matter brought to surface.

Moisten prepared areas before sodding if soil is dry. Do not create a muddy soil condition.

INSTALLATION OF SOD

Apply the other half of the amendments prior to sodding. Rake amendments evenly into the top two inches of soil and thoroughly moisten soil. Lay sod within 48 hours from time of stripping. Do not install sod if ground is frozen.

Lay sod to form solid mass with tightly fitted joints. Lay sod over moistened soil, lightly raking the area ahead of each sod strip. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Lay sod parallel to the contours. Avoid damage to subgrade or sod. Tamp firmly and evenly by hand to ensure contact with subgrade. Unless approved by Architect, do not place sod pieces into gaps between sod strips. Instead, relay sod to close gaps. With approval of the Architect, sand can be sifted into minor gaps smaller than 1/2 inch. Remove excess soil to avoid smothering grass.

Water sod thoroughly with a fine spray immediately after laying, until subsoil is wet to a minimum of four inches.

CLEANING AND ADJUSTING

During the work, keep all pavements clean and work area in an orderly condition.

Protect existing elements from damage due to sodding operations, operations by other contractors, other trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged work to the satisfaction of the Owner at no cost to the Owner.

WARRANTY

Warranty sodded areas for a period of one full year after date of final acceptance against defects including death and unsatisfactory growth as determined by the Architect, unless such failure is determined to be due to the Owner's negligence in following the contractor's recommended maintenance procedure.

Replace dead or unhealthy sod at the end of the warranty period, unless, in the opinion of the Architect, it is advisable to extend the warranty until the next full growing season. If an extended warranty period is enacted, an inspection will be conducted at the end of the extended warranty period to determine acceptance or rejection of plant material under the warranty requirements.

Contractor shall guarantee all sodding, from issue of substantial completion, through specified maintenance period, until issue of final acceptance. This warranty shall exclude damage due to Owner's negligence, vandalism, and/or other destruction.

Maintenance: Contractor shall maintain sod regularly throughout the maintenance period defined in these Specifications. Owner shall provide maintenance afterwards.

Final acceptance shall be issued at end of warranty period, and the Architect / Designer has inspected and is satisfied with all work.

SECTION 03300

CAST-IN-PLACE CONCRETE

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager. This section, and all structural sections shall be reviewed and generated for project specific requirements by project structural engineer.

SUMMARY

Section Includes

Cast-in-place concrete.

Concrete mixes

Accessories

References

American Concrete Institute (ACI)
ACI 301 Specifications for Structural Concrete for Buildings. (Must be available at Project Site at all times.)

ACI 302R Guide for Concrete Floor and Slab Construction.

ACI 305R Hot Weather Concrete work.

ACI 306R Cold Weather Concrete work.

ACI 308 Standard Practice for Curing Concrete.

ACI 309 Standard Practice for Consolidation of Concrete.

ACI 318 Building Code Requirements for Reinforced Concrete.

ACI 503.2 Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive.

American Society for Testing and Materials (ASTM)

ASTM C33 Standard Specifications for Concrete Aggregates.

ASTM C150 Standard Specifications for Portland Cement.

ASTM C171 Standard Specifications for Sheet Materials for Curing Concrete.

ASTM C260 Standard Specifications for Air-Entraining Admixtures for Concrete.

ASTM C309 Standard Specifications for Liquid Membrane Forming Compounds for Curing Concrete.

ASTM C330 Standard Specifications for Lightweight Aggregates for Structural Concrete.

ASTM C494 Standard Specifications for Chemical Admixtures for Concrete.

ASTM C567 Standard Test Method for Unit Weight of Structural Lightweight Concrete

ASTM C618 Standard Specifications for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

ASTM C881 Standard Specifications for Epoxy-Resin-Base Bonding Systems for Concrete.

ASTM D1751 Specification for Performed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

ASTM D1752 Specification for Preformed Sponge Rubber and Cork Expansion Joint Filler for Concrete Paving and Structural Construction.

ASTM E1155 Standard Test Method for Determining Floor Flatness and Levelness Using the F-number System.

SUBMITTALS

Comply with Division 1 and/or general conditions, unless otherwise indicated.

Allow time for architect and engineers review of submittals as detailed in Division 1 and/or general conditions.

Product Data Manufacturer's specifications and technical data including the following

Certified test reports indicating compliance with performance requirements specified herein.

Laboratory reports 3 copies of tests and reports specified.

Concrete Design Mix Submit for each concrete type for review and return prior to placing concrete.

Include description of method by which mix design was formulated and supporting backup data.

Manufacturer's data sheets for admixtures.

Delivery Tickets 1 copy indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump, and time of batching for each load delivered.

Authorization Requests Written requests for authorization for use of admixtures not specified, Site mixing of concrete, and use of bonding agents.

QUALITY CONTROL SUBMITTALS

Statement of qualifications.

Design data.

Test reports.

Standards of Workmanship Comply with ACI References listed above, unless otherwise indicated. See installation guidelines.

Materials

Cement
Unless indicated otherwise use ASTM C150 Types I, IA, III, or IIIA.
For all footings, slabs and retaining walls, use Type V cement.

Coarse Aggregate

For Regular weight concrete use ASTM C33, maximum size as indicated for class of concrete.

For Lightweight concrete use ASTM C330, maximum size as indicated for class of concrete.

Fine Aggregate ASTM C33

Admixtures. Use only the following unless otherwise approved.

Air entraining ASTM C260.

Water reducing ASTM C494, Type A.

Set control ASTM C494, Type B,C,D,E.

Calcium chloride Not permitted.
Edit Note Cementious admixtures not permitted on State Farm Projects.

Cementitious Admixtures must meet the following criteria

Fly Ash ASTM C-618, Class C, loss on ignition - less than 2 percent.

Ground Granulated Blast-Furnace Slag ASTM C989, Grade 120
Maximum percent by weight of total cementitious material in mix of either specified admixture 25

Mix design must provide average 28 day compressive and flexural strength of cured concrete is equal to or in excess of specified values.

Unless otherwise approved, use of admixture type and amount of admixture must be consistent for Project concrete.

Vapor Barrier: 10 mil (minimum) polyethylene sheeting.

Mixes

Concrete Mixes ACI 301, design for the following classes

Class	Strength PSI	Agg Max	Slump In.	Air %	Type	Location
A	4000	¾	3-4	---	Std-Wt	Interior Slabs & Walls
B	4000	¾	3-4	5-7	Std-Wt	Exterior Slabs & Walls
C	4000	1.5	3-5	---	Std-Wt	Footings
D	4000	3/8	1-3	---	Std-Wt	Interior Topping
E	4000	½	3-5	---	Std-Wt	Stair Fill at Landings & Treads
F	4000	½	3-4	---	Lt-Wt	Interior Slabs (where noted)

Air Entrained Concrete In place value as scheduled.

Fly Ash Mixes Do not use in air entrained or architectural concrete.

Light Weight Concrete Density: Lightweight Class, 110 +/-3 pcf air dry weight according to ASTM C567.

Water/Cement Ratio Unless noted shall have all concrete shall have a maximum water/cement ratio of 0.50.   All trowel finished interior slabs, subjected to vehicular traffic, shall have a maximum w/c ratio of 0.48.

Admixture Usage: All concrete must contain the specified water-reducing admixture or the specified high-range water-reducing admixture (superplasticizer). All concrete slabs placed at air temperatures below 50□F shall contain the specified non-corrosive, non-chloride accelerator. All concrete required to be air entrained shall contain an approved air entraining admixture. All pumped concrete, concrete for industrial slabs, synthetic fiber concrete, architectural concrete, concrete required to be watertight or concrete with a water/cement ratio below 0.50 shall contain the specified high-range water-reducing admixture (superplasticizer).

Water : Cementitious Materials Ratio: Cementitious materials include all cement and pozzolan (fly ash, silica fume, etc.) materials.

Cast In Place Walls And Suspended Slabs: 0.45, maximum.
Slabs on grade on Grade: 0.45, maximum.
All other concrete: Comply with requirements found in ACI 318-99.

Accessories or Special Features

Curing Materials ASTM C171, waterproof paper, polyethylene film, white burlap-polyethylene sheet.

Curing Materials for areas not scheduled for other finishes ASTM C309 Type 1 liquid membrane.

Slip-Resistant Aggregate Pure aluminum oxide, silicone carbide, No. 12 to 30 combination.

Expansion Joint Filler

ASTM D1751 for use without sealant.

ASTM D1752, sponge rubber or cork for use where sealant is required.

Bond Breaker 15 pound asphalt felt.

Control Joint Forms T-shaped plastic insert designed to allow removal of top flange after placement. Minimum depth 1/4 slab thickness.

Bonding Agent Epoxy adhesive (ACI 503.2) - ASTM C881 Type II.

INSTALLATION GUIDELINES

Verify Conditions
Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion.
Do not proceed until unsatisfactory conditions have been corrected.

Preparation

Coordination Notify others involved to allow installation and completion of their work prior to concrete placement.

Surface Preparation Immediately before concrete placement, thoroughly wet moisture absorbing material that will be in contact with concrete, without developing standing water.

Installation

Concrete Mixing ACI 301, ready mixed unless permission is given to Site mix.

Hot weathering concrete. Comply with ACI 305 R when maximum daily temperature exceeds 85 degrees F. or rapid drying conditions exist (evaporation rates exceeds 0.15 pounds per square foot per hour. Refer to ACI 305R. Chapter 2).

Cold Weather Concrete Comply with ACI 306R when freezing conditions or a mean daily temperature below 40 degrees F. is encountered.

Manufactured Items. Place manufactured forms and accessories per manufacturer's instructions.

Place concrete within 1-1/2 hours after mix water has been added.

Maximum Free Fall 5 feet.

Concrete Placed on Steel Deck Coordinate placement technique with deck supplier for strength and shoring requirements to avoid damaging deck.

Heavier deck gauge may be used at no expense to Owner.

Columns and Walls Do not pour monolithic with slabs which bear on columns or walls.

New Concrete Placed against Existing Thoroughly clean and wet existing, coat with paste of neat cement and water. Commercial bonding agent may be submitted for approval.

Curbs Provide 3-1/2 inch high concrete curbs around exposed duct openings and pipes not sleeved in unfinished areas (such as store rooms and equipment rooms) over finished rooms or areas.

Tolerances

Concrete slabs on grade shall be placed and finished to a tolerance of FF/30FL20 (specified overall average) and FF20/FL15 (minimum local values).

Structural concrete composite slabs on deck shall be placed and finished to a tolerance of FF25 (specified overall average) and FF15 (minimum local values).

Minimum local values of “F” numbers shall be based on an individual concrete pour, bounded by slab edges or construction joints, or a 30 foot by 30 foot section of each individual pour.

For purposes of flatness and levelness testing, delete Paragraphs 7.2.3 and 7.3.2 of ASTM E1155, except that Paragraph 7.3.2. may be used at columns or at pipe sleeves or conduits which vertically penetrate through the top of the concrete.

Finishes

Exposed Vertical Surfaces: Smooth form finish (only where indicated) shall comply with ACI 301, 10.2.2 and produce a smooth, uniform texture with an orderly pattern of form mark. Coordinate finishes with design documents.

Patch holes and defects. Completely remove fins.

ACI 301 Chapters 10 and 11 set the basis for slab finishes as defined herein. Apply this or other finishes with design documents.

CONC-1 Steel trowel finish consisting of a floated finish as specified in ACI 301 Section 11.7.2, then power troweled, and finally hand troweled to smooth uniform texture free of trowel marks.

At all interior locations, unless otherwise indicated.

Slabs to receive waterproofing membrane.

CONC-2 Light broom finish consisting of steel trowel finish above except delete hand troweling and provide light brooming transversely across surface to uniform scored texture.

Interior stair treads and landings, unless otherwise indicated.

Interior slabs scheduled to receive ceramic tile, stone tile, hardeners, and other coatings.

CONC-3 Light broom finish with grit shall consist of a light broom finish as specified above with an aluminum oxide grit spread over surface at a rate of not less than 25 pounds per 100 square feet.

Use at interior stairs and ramps without carpeting, all exterior stairs and ramps shown on structural drawings and as otherwise indicated on Drawings.

Do not use on surfaces that receive architectural finish.

CONC-6 Wood float finish shall consist of hand float or power bladed trowel with float shoes to comply with ACI 301, 11.7.2.

Slabs scheduled to received concrete topping.

Exposed exterior vertical surfaces smooth rubbed finish unless otherwise indicated.

Concealed surfaces as cast for formed surfaces and floated for slab unless indicated otherwise.

Edit Note Note Revise specs if sand floated or grout cleaned finishes are required (coordinate finish W/Arch)
Slabs to Receive Topping or Similar Finish Scratched finish.

Slabs to Receive Membrane Troweled unless waterproofing manufacturer recommends otherwise.

Future Floors Troweled finish.

Slip-resistant Finish 1/3 pound/square foot of non-slip aggregate placed just prior to first troweling. Apply to exposed stairs, ramps, and dock slabs and scheduled locations.

Curing

Use waterproof sheet materials or liquid membrane. Curing method shall not impair finish or bonding of finish materials.

Do not apply liquid membrane on slabs scheduled to receive ceramic tile, stone tile, hardeners, and other coatings.

Additional curing time and precautions are required for fly ash concrete.

Edit Note Coordinate above requirements with Project Specifier for specific requirements. Many flooring finishes now require damp curing.
Field Quality Control

Duties of the contracted Testing and Inspection Agency :

Contracted testing and inspection agency shall provide inspection and testing listed below and in accordance with the Building Code.

Scope of Batch Plant Inspection: The scope of batch plant inspection by the contracted testing laboratory shall include the following:

Inspection of batch plant facilities: Prior to the start of concrete Work, the Owner’s testing laboratory shall inspect batch plant facilities proposed for use in the Work and report in writing inspection results to the Architect and Construction Manager for approval before the start of the Work.

The inspection shall follow that outline in ASTM C94 and as recommended by the National Concrete Ready Mix Association. Inspection shall include:

Batch plant operations and equipment.

Truck mixers.

Scales.

Stockpile placement.

Material storage.

Admixture dispensers.

Duties of batch plant inspector: The duties of the Owner's testing laboratory batch plant inspector shall include the following:

Perform initial inspection of batch plant facilities as specified above and periodic inspections as follows:

Secure samples of aggregates for testing.

Perform visual inspection of aggregates stockpiles to determine uniformity, cleanliness, and moisture variation to be performed each visit to the plant facility.

Adjust design weights for moisture in aggregates to be performed each visit if required.

Inspect aggregate conveying system for possible segregation to be performed at each visit.

Observe batching procedure at each visit. Verify that concrete mix design number is being batched and randomly monitor weighing operation for correct weights of each mix ingredient, including admixture dosages.

Prior to loading the truck at the batch plant verify that the drum is free of water, fresh concrete, or aggregates. Check conditions and cleanliness of drum, fins, and blades.

During loading, observe loading procedures.

After loading, hold the truck for proper mix time and inspect concrete for thorough mix and consistency prior to leaving the batch plant.

Check size of batch for rated truck capacity.

The technician will initiate concrete mix inspection at the batch plant, then will proceed to the project site with the first truckloadings to continue to inspect the mix at the point of discharge. He will remain at the jobsite to inspect the mix for the required consistency for the duration of the concrete placement.

Concrete Batch Plant Inspection: The following types of concrete inspection shall be provided by the contracted testing laboratory for the classes of concrete described in each type of inspection below.

Continuous concrete inspection: Continuous concrete inspection at the batch plant and point of discharge at the job site shall be followed for the following concrete: All architectural concrete.

The Contracted testing laboratory shall assign the required number of technicians with the necessary equipment for each scheduled placement of the above listed concrete to provide continuous concrete inspection at both the batch plant and the point of discharge at the job site.

Job Site Inspection: The scope of the work to be performed by the Owner's testing laboratory on the jobsite shall be as follows:

Verify that air temperatures at the point of placement in the structure are within acceptable limits defined above prior to ordering of concrete by the Contractor.

Inspect concrete upon arrival to verify that the proper concrete mix number, type of concrete, and concrete strength is being placed at the proper location.

Inspect plastic concrete upon arrival at the jobsite to verify proper batching. Verify that no water has been added at the job site, or in transit.

Obtain concrete test cylinders.

Perform slump tests and air entrainment tests at the point of placement in the structure.

Record information for concrete test reports.

Verify that all concrete being placed meets job specifications. Report concrete not meeting the specified requirements and immediately notify the Contractor, Batch Plant Inspector, Architect, and Construction Manager.

Pick up and transport to laboratory, cylinders cast the previous day.

Check concrete placing techniques to determine that concrete deposited is uniform and that vertical drop does not exceed five feet.

The contracted testing laboratory shall report any irregularities that occur in the concrete at the job site or test results to the Contractor, Architect, and Construction Manager.

Concrete Batch Trip Tickets:

All concrete batch trip tickets shall be collected and retained by the Contractor. Compressive strength, slump, air, and temperature tests shall be identified by reference to a particular trip ticket. All tickets shall contain the information specified in ASTM C 94. The Contractor and contracted testing laboratory shall immediately notify the Architect, Construction Manager and each other of tickets not meeting the criteria specified.

Concrete Test Cylinders by the contracted Testing Laboratory:
Molding and testing:

Field sample cylinders for strength tests shall be molded and laboratory cured in accordance with ASTM C31 "Method of Making and Curing Concrete Test Cylinders in the Field" and tested in accordance with ASTM C39 "Method of Testing for Compressive Strength of Cylindrical Concrete Specimens".

Field samples:

Field samples for strength tests shall be taken in accordance with ASTM C173 "Method of Sampling Fresh Concrete".

Frequency of testing: Each set of test cylinders shall consist of a minimum of four standard test cylinders. A set of test cylinders shall be made according to the following frequency guidelines:

One set for each class of concrete taken not less than once a day.

Columns, Caissons: One set for each 100 cubic yards or fraction thereof.

Footings and Pile Caps: One set for each 100 cubic yards or fraction thereof.

Floors: One set for each 100 cubic yards or fraction thereof but not less than one set for each 5000 square foot of floor area.

All other concrete: A minimum of one set for each 150 cubic yards or fraction thereof.

No more than one set of cylinders at a time shall be made from any single truck.

If the total volume of concrete is such that the frequency of testing as specified above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.

The above frequencies assume that one batch plant will be used for each pour. If more than one batch plant is used, the frequencies cited above shall apply for each plant used.

The cylinders shall be numbered, dated, and the point of concrete placement in the building recorded. Of the four cylinders per set break one at seven days, two at 28 days, and one automatically at 56 days only if either 28 day cylinder break is below required strength.

Cylinder storage box
The Contractor shall be responsible for providing a protected concrete cylinder storage box at a point on the job site mutually agreeable with the testing laboratory for the purpose of storing concrete cylinders until they are transported to the Laboratory.

Transporting cylinders
The contracted testing laboratory shall be responsible for transporting the cylinders to the Laboratory in a protected environment such that no damage or ill effect will occur to the concrete cylinders.

Other Required Tests of Concrete by the contracted Testing Laboratory:

Slump tests:Slump tests (ASTM C143) shall be made at the beginning of concrete placement for each batch plant and for each set of test cylinders made.

Air entrainment: Air entrainment (ASTM C233) tests shall be made at the same time slump tests are made as cited above. Air entrainment test shall be at the pumping discharge.

Concrete temperature: Concrete temperature at placement shall be measured at the same time slump tests are made as cited above.

Information on concrete test reports: The contracted testing laboratory shall make and distribute concrete test reports after each job cylinder is broken. Such reports shall contain the following:

Truck number and ticket number.

Concrete batch plant.

Mix design number.

Accurate location of pour in the structure.

Strength requirement.

Date cylinders made and broken.

Technician making cylinders.

Concrete temperature at placing.

Air temperature at point of placement in the structure.

Amount of water added to the truck at the batch plant and at the site and whether it exceeds the amount allowed by the mix design.

Slump.

Unit weight.

Air content.

Cylinder compressive strengths with type of failure if concrete does not meet specification requirements. Seven day breaks are to be flagged if they are less than 60 percent of the required 28 day strength. 28 day breaks are to be flagged if either cylinder fails to meet specification requirements.

Causes for Rejection of Concrete: The Contractor shall reject all concrete delivered to the site for any of the following reasons:

Wrong class of concrete (incorrect mix design number).

Concrete with temperatures exceeding 95 degrees F. may not be placed in the structure.

Air contents, as determined by the Owner’s testing laboratory, outside the limits specified in the mix designs.

Slumps, as determined by the Owner’s testing laboratory, outside the limits specified in the mix design.

Excessive age: Concrete shall be discharged within 90 minutes of plant departure or before it begins to set if sooner than 90 minutes, unless approved by the Owner’s testing laboratory job inspector or other duly appointed representative.

Water added at job site, or in transit.

The Contractor is responsible that all concrete placed in the field is in conformance to the Contract Documents.

EVALUATION AND ACCEPTANCE OF CONCRETE:

Strength test
A strength test shall be defined as the average strength of two 28 day cylinder breaks from each set of cylinders.

Quality control charts and logs: The contracted testing laboratory shall keep the following quality control logs and charts for each class of concrete containing more than 2,000 cubic yards. The records shall be kept for each batch plant and submitted on a weekly basis with cylinder test reports:

Number of 28 day strength tests made to date.

28 day strength test results containing the average of all strength tests to date, the high test result, the low test result, the standard deviation, and the coefficient of variation.

Number of tests under specified 28 day strength.

A histogram plotting the number of 28 day cylinders versus compressive strength.

Quality control chart plotting compressive strength test results for each test.

Quality control chart plotting moving average for strength where each point plotted is the average strength of three previous test results.

Quality control chart plotting moving average for range where each point plotted is the average of 10 previous ranges.

Acceptance criteria: The strength level of an individual class of concrete shall be considered satisfactory if both of the following requirements are met.

The average of all sets of three consecutive strength tests equal or exceed the required f'c.

No individual strength test (average of two 28 day cylinder breaks) falls below the required f'c by more than 500 PSI.

If either of the above requirements is not met, the contracted testing laboratory shall immediately notify the architect, construction manager, and owner's representative associated with the project by telephone. Steps shall immediately be taken to increase the average of subsequent strength tests.

Investigation of Low Strength Concrete Test Results:

Contractor responsibility for low strength concrete

If any strength test of laboratory cured cylinders falls below the required f'c by more than 500 psi, the Contractor shall take steps immediately to assure that the load carrying capacity of the structure is not jeopardized. All related services of the contracted testing laboratory shall be borne by the contractor in accordance with item 1.06.H and item 1.07.A.

Nondestructive field tests
The contracted testing laboratory shall under the direction of the Architect perform nondestructive field tests of the concrete in question using Swiss Hammer, Windsor Probe, or other appropriate methods as approved by the Architect and report the results in the same manner as for cylinder test reports.

Core tests:

If the likelihood of low strength concrete is confirmed and computations indicate that the load carrying capacity of the structure has been significantly reduced, tests of cores by the contracted testing laboratory, drilled from the area in question under the direction of the Architect, will be required in accordance with ASTM C42 "Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete". In such case, three cores shall be taken for each strength test more than 500 psi below required f'c. If concrete in the structure will be dry under service conditions, cores shall be air dried (temperature 60 degrees to 80 degrees F., relative humidity less than 60 percent) for 7 days before test and shall be tested dry. If concrete in the structure will be more than superficially wet under service conditions, cores shall be immersed in water for at lest 48 hours and tested wet. The Contractor shall fill all holes made by drilling cores with an approved drypack concrete.

Acceptance criteria for core tests
Concrete in an area represented by core tests shall be considered structurally adequate if the average of three cores is equal to at least 85 percent of f'c and if no single core is less than 75 percent of f'c. If approved by the Architect, locations of erratic core strengths may be retested to check testing accuracy.

Load test
If the above criteria are not met and the structural adequacy remains in doubt, the Architect may order a load test as specified in ACI 318 for the questionable portion of the structure. The contracted testing laboratory shall perform or monitor this load test.

Strengthening of the structure, or demolition, or excavation
If the structural adequacy of the affected portion of the structure remains in doubt, the Architect may order the structure to be strengthened by an appropriate means or demolished or excavated and rebuilt.

Concrete Finish Measurement:

Measurement Standards: All floors indicated to have flatness/levelness tolerances shall be measured for flatness and levelness according to ASTM E 1155 "Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System".

Time Period for Measurement and Reporting: Measurement of the finished concrete surface profile for any test section shall be made by the contracted Testing Laboratory within 24 hours after completion of finishing operations. For structural elevated floors measurement shall also be made prior to removal of forms and shores. The Contractor shall be notified immediately after the measurements of any section are complete and a written report of the floor measurement results shall be submitted within 72 hours after finishing operations are complete.

Measuring Equipment: The concrete surface profile shall be measured using equipment manufactured for the purpose such as a Dipstick Floor Profiler as manufactured by the Edward W. Face Company in Norfolk, Virginia, optical or laser means or other method specified in ASTM E 1155.

Floor Test Sections: For purposes of this specification, a floor test section is defined as the smaller of the following areas:

The area bounded by column and/or wall lines.

The area bounded by construction and/or control joint lines.

Any combination of column lines and/or control joint lines.

Test sample measurement lines within each test section shall be multidirectional along two orthogonal lines as defined by ASTM E 1155.

The precise layout of each test section shall be determined by the contracted testing agency and shall be submitted for Construction Manager and Architect review and approval.

Extent of Testing: The following outlines the minimum testing to be performed on the respective floor slabs. Additional testing will be requested by the Construction Manager if deemed necessary.

Event Floor Level: Test a total of 40 randomly selected sections.

Other Floor Levels: Test a total of 20 randomly selected sections on each floor.

The Testing Laboratories' written reports must clearly identify the locations of each section tested.

Prior to any concrete placement, the contracted Testing Laboratory shall inspect anchor bolts as described in the installation guidelines.

Inspections Verify formwork, reinforcing steel, inserts, and items are complete, accurately placed, clean, and secure.

Repair of Concrete Surfaces

Tie Holes Patching not required.

Concrete Surfaces under Waterproofing Remove fins and fill voids and tie holes as recommended by waterproofing manufacturer.

Cutting and patching existing floor slab. Score with 1 inch deep sawcut. Remove slab with jackhammer or similar method to leave a rough exposed edge. Patch with new concrete and finish to match existing slab. Typical membrane waterproofing will require a steel troweled finish, damp cured.

SECTION 03331

CAST-IN-PLACE ARCHITECTURAL CONCRETE

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for architectural concrete that will be exposed to view and may require non-standard formwork and/or finishes.

System Design and Performance Requirements

General

In general, all of the items included in Section 03300 – Cast-In-Place Concrete, will apply. This section shall be included when concrete will be exposed and special finishes may require non-standard formwork, special design mixes (for color or texture) and services of a specialized consultant to assist the Contractor in providing the required design results.

All of the above items should be considered if special finishes are desired. Attempts to get them without the benefit of special attention and/or an expert in this field will result in poor quality, compromised design and possibly additional charges on the part of the Contractor in connection with efforts to provide what was not specified or detailed.

Drawings must be very specific concerning the detailing for Architectural Concrete.

QUALITY ASSURANCE

Field sample panels may be used to verify that Contractor can produce cast-in-place architectural concrete of required finish, color, and texture. On simpler projects, field samples may suffice and make mockups unnecessary. For more complex projects, field samples may be needed before producing full-scale mockups.

Field Sample Panels: After approval of verification sample and before casting architectural concrete, produce field sample panels to demonstrate the approved range of selections made under sample submittals. Produce a minimum of 3 sets of full-scale panels, cast vertically, approximately 48 by 48 by 6 inches (1200 by 1200 by 150 mm) minimum, to demonstrate the expected range of finish, color, and texture variations.

Delete first paragraph below if field sample panels will suffice and added expense of mockups is not required. If retaining, indicate location, size, and other details of mockups on Drawings.
Mockups: Before casting architectural concrete, build mockups to verify selections made under sample submittals and to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

Preinstallation Conference: Conduct conference at Project site.

SUBMITTALS

Provide product data, design mixtures, formwork shop drawings, placement schedule, as well as samples of all materials proposed to be used.

Materials

Form-Facing Materials

General: Comply with Division 3 Section "Cast-in-Place Concrete" for formwork and other form-facing material requirements.

Form-Facing materials may include special form panels in steel, glass-fiber reinforced plastic, or other approved non-absorptive panel materials that will provide continuous, true, and smooth architectural concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

Other materials may include form liners; rustication strips; chamfer strips; form ties, etc.

Steel Reinforcement and Accessories
General: Comply with Division 3 Section "Cast-in-Place Concrete" for steel reinforcement and other requirements for reinforcement accessories.

Concrete Materials
Cementitious Material: Use the same concrete materials, admixtures, water etc. as noted in 03300, unless noted otherwise by the Structural Engineer.

Select class of aggregate from options in first paragraph below or revise to suit Project. ASTM C 33 limits deleterious substances in coarse aggregate depending on climate severity and in-service location of concrete. Exposed architectural concrete is classified as Class 5S or 5M. For negligible weathering regions, Class 1N is stricter than Class 2N. Retain last option if damage caused by concrete expansion from alkali-silica or alkali-carbonate reactions may be anticipated.
Concrete Mixtures

Prepare design mixtures for each type and strength of cast-in-place architectural concrete proportioned on basis of laboratory trial mixture or field test data, or both, according to ACI 301.

Use a qualified independent testing agency for preparing and reporting proposed design mixtures based on laboratory trial mixtures.

Delete paragraph below if integrally colored concrete is not required.
Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

Finishes

Architectural Concrete Finish: Match Architect's design reference sample, identified and described as indicated, to satisfaction of Architect.
Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces.

Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

Maintain uniformity of special finishes over construction joints, unless otherwise indicated.

Sandblasting and other similar types of finished can be very disruptive and messy, that is not easily accomplished on an occupied campus. Compliance with all Clark County and State Air Quality Standards will be required.

INSTALLATION GUIDELINES

General: Comply with Division 3 Section "Cast-in-Place Concrete" for formwork, embedded items, and shoring and reshoring.

In addition to ACI 303.1 limits on form-facing panel deflection, limit cast-in-place architectural concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

Fabricate forms to result in cast-in-place architectural concrete that complies with ACI 117, “Specifications for Tolerances for Concrete Construction and Materials.”

Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

Place form liners accurately to provide finished surface texture indicated. Provide solid backing and attach securely to prevent deflection and maintain stability of liners during concreting. Prevent form liners from sagging and stretching in hot weather. Seal joints of form liners and form liner accessories to prevent mortar leaks. Coat form liner with form-release agent.

When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for cast-in-place architectural concrete surfaces.

Repairs and Protection
Repair and cure damaged finished surfaces of cast-in-place architectural concrete when approved by Architect. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.

Remove and replace cast-in-place architectural concrete that cannot be repaired and cured to Architect's approval.

Protect corners, edges, and surfaces of cast-in-place architectural concrete from damage; use guards and barricades.

Protect cast-in-place architectural concrete from staining, laitance, and contamination during remainder of construction period.

SECTION 04100

MORTAR AND MASONRY GROUT

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section includes mortar and grout for masonry.

Related Sections

Section 01400 - Quality Control.

Section 04300 - Unit Masonry System.

Section 08111 – Steel Doors, Windows and Frames.

References

ASTM C91 - Masonry Cement.
ASTM C94 - Ready-Mixed Concrete.
ASTM C144 - Aggregate for Masonry Mortar.
ASTM C150 - Portland Cement.
ASTM C207 - Hydrated Lime for Masonry Purposes.
ASTM C270 - Mortar for Unit Masonry.
ASTM C387 - Packaged, Dry, Combined Materials, for Mortar and Concrete.
ASTM C404 - Aggregates for Masonry Grout.
ASTM C476 - Grout for Masonry.
ASTM C780 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced

Unit Masonry.
ASTM C1019 - Method of Sampling and Testing Grout.

International Building Code (IBC), 2003 edition.

SUBMITTALS

Submit under provisions the front end and/or general conditions.

Product Data
Submit manufacturer's data on materials where Owner's acceptance is required.

Mix Design
Indicate Proportion or Property method used, required environmental conditions, and admixture limitations. All mix designs shall bear the project name and the location where the mix is to be used. All mix
designs shall bear the wet seal and signature of a Registered Professional Engineer licensed to practice in the State of Nevada.

Samples

Submit two (2) ribbons of mortar color, illustrating color and color range.

Test Reports

Submit reports on mortar indicating conformance to ASTM C270.

Submit reports on grout indicating conformance to ASTM C476.

Delivery, Storage, And Handling

Deliver store and protect products under provisions of the front end and/or general conditions.

Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

Environmental Requirements
Maintain materials and surrounding air temperatures to minimum 50 degrees F (10 degrees C) prior to, during, and forty-eight (48) hours after completion of masonry work, or provide satisfactory evidence of compliance with cold weather requirements of IBC.

MATERIALS

Portland Cement: ASTM C150, Type II; Type V cement for mortar and grout in block placed below grade.

Masonry Cement: ASTM C91, Type S.

Mortar Aggregate: ASTM C144, standard masonry type.

Hydrated Lime: ASTM C207, Type S.

Premix Mortar: ASTM C387, using white cement, Normal strength Type S. Submit manufacturer's data for approval.

Grout Course Aggregate: ASTM C404.

Water: Clean and potable.

Bonding Agent: Submit for approval.

Mortar Color
Color to match masonry unit; manufactured by SGS or approved equal.

Admixtures
Plasticizer: Water reducing type which reduces porosity and absorption to increase bond strength; submit for approval.

Mortar Mixes

Mortar for Walls and Partitions

ASTM C270, Type S, utilizing the Proportion Method to achieve compressive strength noted on structural drawings; or where none is indicated not less than shown in MORTAR PROPORTIONS FOR UNIT MASONRY Table of the IBC. Notes on structural drawings govern.

Pointing Mortar
ASTM C270, Type N, using the Property Method with maximum two percent (2%) ammonium stearate or calcium stearate per cement weight.

Stain Resistant Pointing Mortar
One part Portland cement, 1/8 part hydrated lime, and two (2) parts graded (80 mesh) aggregate, proportioned by volume. Add aluminum tristearate, calcium stearate, or ammonium stearate equal to two (2) percent of Portland cement by weight.

Do Not use calcium chloride in mortar.

Mortar Mixing

Thoroughly mix mortar ingredients in the proportions required by the IBC for immediate use in accordance with ASTM C270 or C780.

Add mortar color and approved admixtures in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.

Do not use anti-freeze compounds to lower the freezing point of mortar.

If water is lost by evaporation, retemper only within two (2) hours of mixing.

Use mortar within two (2) hours after mixing at temperatures of 80 degrees F (26 degrees C), or two-and-one-half hours at temperatures under 50 degrees F (10 degrees C).

Grout Mixes

Engineered Masonry
Grout mix as noted on structural drawings but not less than 2000 psi strength at 28 days; 7-10 inches slump; premixed type in accordance with ASTM C94, or mixed in accordance with ASTM C476 and IBC requirements for coarse grout. Grout strength may have to be increased in order to obtain an f’m=1500 psi.

Comply with water-repellant admixture manufacturer’s recommendations for slump and consistency.

Grout Mixing

Mix concrete in accordance with ASTM C94.

Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C476 grout, and in accordance with GROUT PROPORTIONS BY VOLUME Table of the IBC.

Add admixtures in accordance with manufacturer's instructions. Provide uniformity of mix.

Do not use anti-freeze compounds to lower the freezing point of grout.

Do not use fly ash.

Mix Tests

Testing of mortar and grout shall be performed by an independent testing laboratory in accordance with the front end and/or general conditions.

Testing of Mortar Mix
Test mortar mix for compressive strength, consistency, mortar aggregate ratio, water content, and air content in accordance with ASTM C780.

Testing of Grout Mix: Test grout mix for compressive strength and slump in accordance with ASTM C1019.

INSTALLATION GUIDELINES

Preparation

Request inspection of spaces to be grouted.

Plug cleanout holes with block masonry units to prevent leakage of grout materials. Brace masonry for wet grout pressure.

Installation

Install mortar and grout to requirements of the specific masonry sections.

Work grout into masonry cores and cavities to eliminate voids.

Do not displace reinforcement while placing grout.

Remove grout spaces of excess mortar.

Form bottom of bond beams with approved type metal lath or manufactured product. In no case use cardboard, paper, or unapproved materials.

Schedules
CMU Masonry: Type S mortar with Type N pointing mortar (or as noted on structural drawings).

SECTION 04900

MASONRY RESTORATION AND CLEANING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for masonry restoration and cleaning.

System Design and Performance Requirements

The preservation of UNLV's historic masonry buildings is critical to maintaining the character of the campus. When undertaking masonry restoration and cleaning, use extreme care to renew and extend the life of these buildings. Specify the minimum possible treatment necessary to attain a clean masonry surface.

Refer to the National Park Service publication, "Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing," which can be found at: http://www2.cr.nps.gov/tps/standeuide/index.hlm

During the design phase, review products and methods for masonry cleaners, pointing, and color of mortar with UNLV.

SUBMITTALS

Submit a list of cleaning products and methods to UNLV, and specify the recommended mortar color.

SPECIAL REQUIREMENTS

Masonry restoration and cleaning may entail unforeseen changes in the work. To maintain fair pricing to UNLV for changes in construction work, the bid documents should contain a bid schedule of anticipated types of work (by architect), unit prices (by contractor), anticipated quantities (by architect), the cost of work (by contractor), additional work unit prices (by contractor), verified final quantities, and the final cost of work. This bid schedule enables adjustments, based on quantity, to fairly compensate for increases or decreases in the scope of work. The owner, architect, and contractor must document and agree on the final scope of work.

CLEANING AND ADJUSTING

Take the necessary precautions to protect adjacent materials, buildings, and people in the area from masonry restoration and cleaning activities. Refer to environmental, health, and safety dust control measures.

Use wet methods or vacuum systems to minimize dust.

Control dust at the building exterior and at air intakes to the building's ventilation system.

Seal all openings in the building envelope, including windows and doors, during dusty operations.

When the HVAC systems allows, the building air pressure should be positive to keep dust from infiltrating through windows and doors.

QUALITY CONTROL

Masonry restoration contractors must provide UNLV with evidence of similar work and must have at least five years experience.

SECTION 04810

UNIT MASONRY ASSEMBLIES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

Section contains general design criteria for Unit Masonry Assemblies.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Masonry Selection

The architect will coordinate masonry selection with the UNLV Planning and Construction Project Manager. Masonry selection prior to bidding is required. A/E will select three masonry suppliers that meet standards for block specifications and color. Finish boards shall include 4 inch x 4 inch samples for each type and color of masonry block used.

Masonry shall be selected for durability and low maintenance.

Split-face block is approved for exterior use only. Do not use split face block as an interior wall finish.

Specifications: Split face tolerances must be defined as 1/2-inch maximum from the face. A maximum tolerance of 3/4-inch total deviation will be allowed.

Drawing Coordination: Where split-faced block is used, provide smooth face block at signs, hose bibs, lighting, outlets, etc. Coordinate location of all wall-mounted items.

MASONRY FINISH

Seal all masonry with two coats of a non-staining UV resistant sealer.

Do not specify acidic cleaners for masonry in areas adjacent to stone surfaces, and where existing landscape materials may be damaged by run-off.

Metal parapet cap shall be required for all exterior walls. Slope cap towards roof to avoid staining exterior wall finishes. Cap stones will not be allowed.

All masonry color shall be integral.

Paint or stain cannot be applied to masonry to achieve uniformity.

Sand blasting shall not be allowed on visible masonry surfaces.

Specifications shall include the statement, “masonry units with factory applied silicone coatings are not acceptable”.

Provide anti-graffiti coatings on all masonry walls that extend below 8 feet.

MASONRY INSTALLATION

The specifications state "brick shall be broken out of pallets and intermixed on the site prior to installation, to ensure color randomness".

Avoid installing low masonry walls adjacent to hard surfaces to help prevent skateboard damage.

Specify requirements for continuous or periodic special inspection of masonry, as approved by UNLV.

JOINTS

Specify tooled joints in all masonry exposed to weather. Raked, struck, or other similar joints in masonry may be used only with units not exposed to the weather.

Coordinate control joints with the structural engineer. Provide appropriately spaced control joints. Control joints shall be shown on building elevations and floor plans in the Design Development submittal.

Drawing Coordination: Show control joints on building elevations and floor plans in design development submittal

SUBMITTALS

Erect sample wall panel prior to installation of masonry work, min. 4 feet x 4 feet or 6 course high x 6 unit wide panel (whichever is larger), for each block type. The panel shall remain on site throughout masonry work.

The Contractor's work shall be held to approved mock up standard for masonry color, grout color, joint consistency, and surface tolerances

SECTION 05030

METAL COATINGS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for metal coatings and includes the preparation, protective coating and painting of exposed metal surfaces.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

All exposed metal shall have a protective coating.

Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated.

Indicate paint colors in a separate schedule or show location and extent on Drawings. The number of colors used on a project and use of deep-tone colors will affect Project cost. See the Evaluations in Division 9 Section "Painting."

Exterior Primer: Exterior alkyd or latex-based primer of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.

Ferrous-Metal and Aluminum Substrates: Rust-inhibitive metal primer.

Zinc-Coated Metal Substrates: Galvanized metal primer.

Where manufacturer does not recommend a separate primer formulation on substrate indicated, use paint specified for finish coat.

Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

Exposed Surfaces: Include areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.

Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

Submit product data, samples, 1 foot by 1 foot mockup of each finish, and a composition breakdown of the proposed coating and paint product to ensure compliance with UNLV Paint Composition Standards.

Products and paint systems must be approved by UNLV.

Use schedule below as a guide only. See suggested procedures in "Writing Guide" Article in the Evaluations in Division 9 Section "Painting" for guidance before editing schedule.

SECTION 05120

STRUCTURAL STEEL

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria relative to structural steel framing.

SYSTEM DESIGN AND REQUIREMENTS

All structural steel and their connections shall be designed, fabricated and erected in accordance with the latest specifications of the American Institute of Steel Construction.

The Engineer of Record shall:
1. design and detail all connections on the structural drawings, or
2. review and approve all shop drawings, including connections designed and detailed by the Fabricator. For connections to be designed by the Fabricator, the Engineer of Record shall clearly indicate all design loads on the drawings.

QUALITY ASSURANCE

Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Sbd.

Comply with applicable provisions of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

SUBMITTALS

Product Data: For each type of product designed and to be erected.

Shop Drawings: Show fabrication of structural-steel components.

PRODUCT STANDARDS

Structural Steel

The allowable types and grades of all structural steel, plate, bar, pipe, tubes, bolts and associated materials shall be specified in the construction documents.

Shop prime steel surfaces except as required for field fabrication, sprayed fire-resistive materials, galvanized surfaces.

QUALITY CONTROL

Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports. Comply with testing and inspection requirements of Part 3, Article "Field Quality Control."

Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

SECTION 05500

METAL FABRICATIONS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for miscellaneous metal items and fabrications.

System Design and Performance Requirements
In general, miscellaneous metal items such as lintels, embeds, grating, ladders, bollards, stair nosings, trim and similar architectural features shall be designed and sized to meet codes and their applications.

SUBMITTALS

Shop Drawings: Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

Templates: For anchors and bolts.

Samples: For each type and finish of extruded nosing and tread.

MATERIALS

Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.
All metals shall meet ASTM standards, applicable for specific shape, type.

Nonshrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107.

Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

INSTALLATION GUIDELINES

Fabrication

Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.

Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 24 inches (600 mm) o.c.

Miscellaneous Framing and Supports: Provide steel framing and supports not specified in other Sections as needed to complete the Work. Fabricate units from steel shapes, plates, and bars of welded construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.

Miscellaneous Steel Trim: Fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

Metal Bollards shall be a minimum of 6 inch diameter.

INSTALLATION

General: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, with edges and surfaces level, plumb, and true.

Welds shall be ground and sanded smooth for uniform painted appearance. The use of “Bondo” to fill large gaps and holes is discouraged.

All sharp corners shall be radiused a minimum of 1/8”.

SECTION 05511

METAL STAIRS AND HANDRAILS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for metal stairs and handrails.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Performance Requirements

Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
- Uniform Load: 200 lbf/sq. ft.
- Concentrated Load: 400 lbf applied on an area of 4 sq. in.
- Uniform and concentrated loads need not be assumed to act concurrently.

Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.

Limit deflection of treads, platforms, and framing members to L/480 or 1/8 inch, which is less.

Provide metal stairs capable of withstanding the effects of earthquake motions determined according to ASCE 7, “Minimum Design Loads for Buildings and other Structures” and conforming to the requirements of latest adopted local codes.

QUALITY ASSURANCE

Installer Qualifications: Fabricator of products.

NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

SUBMITTALS

Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

Provide templates for anchors and bolts specified for installation under other Sections.

For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for stairs.

PRODUCT STANDARDS

Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

INSTALLATION GUIDELINES

Fabrication, General

Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

Join components by welding, unless otherwise indicated.

Use connections that maintain structural value of joined pieces.

Pre-assembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

Form exposed work true to line and level with accurate angles and surfaces and straight edges.

Weld connections to comply with the following:

Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

Obtain fusion without undercut or overlap.

Remove welding flux immediately.
Weld exposed corners and seams continuously, unless otherwise indicated.

At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch.

Avoid the use of metal pans for exterior stairs and shall only be used when approved by UNLV. When used in exterior applications, all metal pans and other associated metal stair components shall be galvanized or 100% seal weld with all metal pan surfaces epoxy painted prior to filling with concrete to alleviate the development of rust on any hidden or confined surfaces.

SECTION 06200

FINISH CARPENTRY

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for finish carpentry. The designer is responsible for specifying and designing details for UNLV's approval.

PRODUCT STANDARDS

Finish carpentry products must conform to AW1 quality standards, custom-grade.

Materials

Finish carpentry materials must conform to the following standards.

Exterior Finish Carpentry

Use of exterior shall be avoided.

Trim and boards for transparent finishes must be western red cedar, Grade B and better, number 1 and 2 clear.

Trim and boards for painted finishes must be hardwood suitable for exposure and loading.

Plywood for painted finishes must be APA-rated, exterior, medium-density, overlay plywood.

Interior Finish Carpentry

Trim, boards, and plywood for transparent finishes must be hardwood of a species required by the designer, or as required to match existing trim, boards, and plywood. Sequence match veneers for plywood.

Trim and boards for painted finishes must be hardwood suitable for exposure and use.

Shelving

Shelving must be solid hardwood, plywood with hardwood edge bands, or high-density particleboard, faced on all sides and edges with plastic laminate.

Shelving at labs shall be appropriate for the lab use and approved by UNLV and user.

Material thickness or reinforcement must be appropriate for the shelf loads, with regard to shelf depth and span.

Items in contact with roofing, flashing, waterproofing, masonry, concrete, or the ground must be pressure-treated with a waterborne preservative. The vehicle for the preservative must be compatible with the finish.

Where required by code or local authorities, use ASTM E 84, Class A fire-retardants. The vehicle for the fire-retardant preservative must be compatible with the finish.

INSTALLATION GUIDELINES

Run trim in single lengths to the extent possible.

All carpentry work must be set to required levels and lines, with members plumb, true, and cut to fit.

SECTION 06400

ARCHITECTURAL WOODWORK

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for architectural woodwork, including the installation of shop-fabricated exposed woodwork and casework.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Certification Requirements
Manufacturers must be AWI-certified.

SUBMITTAL

Shop Drawings must:

Indicate the physical dimensions and details or profiles of all elements of the work, including the location of different grades, species, and/or finishes.

Provide dimensions, details, and specific directions for all blocking required for installation

Indicate dimensions, details, and specific directions for all cutouts or easements required for equipment, accessories, utilities, or service access.

PRODUCT STANDARDS

Architectural woodwork products must conform to AWI quality standards, custom-grade, unless otherwise indicated or approved.

Materials

Architectural woodwork materials must conform to the following standards.

Wood Species

With transparent finishes, use the hardwood species required by the designer or a species that matches the existing hardwood.

With painted finishes, use a closed-grain hardwood suitable for the exposure and loading.

With laminate backings, use at least 45 lb density particleboard.

Veneer Matching
Use the veneer required by the designer or a veneer that matches the existing veneer.

Plastic Laminate
Use NEMA LD-3,0.050" thick horizontal-grade plastic laminate at exposed surfaces. Use 0.020" thick horizontal-grade laminate at semi-exposed parts, such as cabinet liners. The designer will select the color, texture, and pattern.

Solid Surfacing
Use Dupont" Corian® solid surfaces or an approved equivalent.

Casework and Counters
With transparent, painted, or plastic laminate finishes, use AWI custom-grade wood.

Hardware
Use stainless steel hardware. Brass may be used as an exception depending on the scope of work.

Glass, Doors, and Shelves
Use tempered safety glass.

Finishes

For transparent finishes, use:

Catalyzed polyurethane

AWI finish system TR-6

Custom-grade

For opaque finishes, use:

Catalyzed vinyl

AWI finish system OP-5

Custom-grade

Fire-Retardant Treatment

Where required by code or local authorities, use ASTM E 84, Class A fire-retardants. The vehicle for the fire-retardant preservative must be compatible with the finish.

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Technical Design Guidelines

SECTION 06402

INTERIOR ARCHITECTURAL WOODWORK

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for interior architectural woodwork, plastic laminate materials and solid surfacing.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

A/E to establish casework with UNLV during design development, including all keying needs, plumbing, mechanical and electrical interfaces.

During design phases, illustrate all casework plans, elevations and identify quality of all millwork at a minimum of 1/4” scale or larger. Details shall be shown at 3” = 1”-0” minimum, when required.

Use custom grade millwork or better, per AWI Quality Certification. Economy grade millwork will not be accepted.

Submittals: A/E shall require that samples of all woodwork and plastic laminates and/or solid surface materials be provided during the construction submittal process. Samples shall be of sufficient size to adequately illustrate material and patterns if appropriate.

Materials

General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

Wood Species and Cut for Transparent Finish: To be recommended to UNLV for approval.

Wood Products: Comply with the following:
Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:

- Formica
- Nevamar
- Wilsonart
- Lamin-Art, Inc.
- Panolam Industries International Incorporated (Pionite).

Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

Manufacturer: Subject to compliance with requirements, provide products by one of the following:

- Formica Corporation
- Corian
- Or an approved equal

Type: Standard type or Veneer type made from material complying with requirements for Standard type, as indicated, unless Special Purpose type is indicated.

Colors and Patterns: As approved by UNLV

Cabinet Hardware and Accessories

General: Provide cabinet hardware and accessory materials associated with architectural cabinets.

Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.

Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

Shelf Rests: BHMA A156.9, B04013; metal.

Drawer Slides: BHMA A156.9, B05091.

Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.

Exposed Hardware Finishes: As selected from manufacturer’s full range of standard.

For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

Miscellaneous Materials

Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content. Wall blocking shall be steel sheet; see “Gypsum Board Assemblies” Blocking, Bracing and Backing Plate.

Adhesives, General: Do not use adhesives that contain urea formaldehyde.

VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

Adhesive for Bonding Plastic Laminate: Unpigmented contact cement, PVA or Urea resorcinol as per manufacturers recommendation.

Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

INSTALLATION GUIDELINES

Grade: Install woodwork to comply with requirements for the same grade specified for fabrication of type of woodwork involved.

Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication, to extent that it was not completed in the shop.

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.

SECTION 07130

WATERPROOFING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for Waterproofing.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Waterproofing Locations
Provide waterproofing at the following locations:

A. Below-grade at the perimeter of the structure in locations subject to hydrostatic pressure.
B. Exterior decks or plazas that form a roof over enclosed space.
C. Pools or fountains.
D. Toilet rooms and shower floors over occupied areas.
E. Mechanical room floors and custodial room floors over occupied areas.
F. Waterproof all floors that house HVAC equipment.
G. Elevator Pits.

General Performance Requirements

A. Waterproofing systems must prevent the infiltration of water and moisture through specific building components.
B. Waterproofing systems must show evidence of successful performance for a minimum of five (5) years.
C. Waterproofing systems must have extremely minimal permeability.
D. Waterproofing systems must have extremely minimal emulsification or degradation in a constant water environment.
E. Waterproofing systems must have high elasticity.
F. Waterproofing systems must have crack bridging capability, to limit approved by manufacturer.
G. Waterproofing systems must exhibit leak location characteristics by preventing the migration of water under the waterproofing.
H. All waterproofing system components must be compatible products as recommended by the manufacturer. The components must be applied according to the manufacturer's instructions.
I. All waterproofing membranes, except fluid, sprayed, or crystalline materials, must be terminated with a non-corrosive metal bar. The bar must be subject to the membrane manufacturer's approval.
J. Waterproofing systems must resist the effects of de-icing chemicals.
K. Waterproofing systems must have watertight compatibility at tie-ins to existing systems.
L. Fumes must be minimized during installation.
M. Specific Performance Requirements
N. Whenever possible and appropriate, the waterproofing system for a given condition must respond to project-specific needs, including the following:

O. Below-grade perimeter wall waterproofing subject to hydrostatic pressure must have the following characteristics:
P. High-static loading (so drainage composite sheet dimples are not driven into the insulation, damaging the membrane itself)
Q. Structural integrity that is greater than the structural burden, including anticipated live loading.

R. Mechanical room floor waterproofing over occupied areas must have the following characteristics.
S. Resistance to wear from foot traffic
T. Slip resistance when wet or dry

SUBMITTALS

Submit the following design and construction documents to the UNLV Project Manager.

Design Development Documents

Submit documentation of the intended systems for review that includes the following:

An understanding of the conditions that require waterproofing

A description of the system to be installed

Materials to be used

Evidence of successful applications

Details of each typical waterproofing condition must be drawn at large scale, so that all components are clearly shown and labeled.

Construction Documents

Specifications to require the contractor to submit product data for all waterproofing materials. Include material, warranty, and installation instructions.

Specifications to require the contractor to submit installer certification that the manufacturer has provided training in the installation of warranted waterproofing materials.

Materials

A. Waterproofing materials for specific applications must conform to the following standards.
B. Below-Grade Waterproofing
C. Below-grade waterproofing materials may include the following:
D. Asphalt/polyethylene sheet consisting of a self-adhering, rubberized asphalt membrane bonded to polyethylene sheeting
E. At least 0.060" thick, with 0.004" polyethylene film
F. Bituthane manufactured by W.R. Grace and Company or an approved equivalent
G. Thermoplastic membrane consisting of polyvinyl chloride (PVC) flexible sheets
H. Conforms to ASTM D4434 standards
I. Manufactured by Sarnafil Waterproofing Systems, Inc.
J. Bentonite waterproofing consisting of Volclay Type I panels
K. Manufactured by American Colloid Company or an approved equivalent
L. Primer
M. Rubber based type
N. Free of toxic solvents
O. Compatible with waterproofing
P. Prefabricated geocomposite drainage core

Q. High impact polymeric drain core
R. Flow channels on one side
S. Filter fabric bonded to the molded dimples
T. Protection board consisting of 1/8" thick asphaltic core

U. PC-2 protection board manufactured by WR Meadows, Inc. or an approved equivalent

Exterior Plaza Waterproofing
The designer must provide a waterproofing recommendation for approval by UNLV. Facilities suggested manufacturer: Neogard Pedigard II-fluid applied.

Pool and/or Fountain Waterproofing
The designer must provide a waterproofing recommendation for approval by UNLV. Facilities suggested manufacturer: Neogard Pedigard II-fluid applied.

Toilet Room and Shower Floor Waterproofing
Use a cold-applied, liquid rubber membrane and reinforcing fabric by Laticrete 9235. Use a polyethylene membrane system by Schluter-DITRA, or an approved equivalent.

Mechanical Room Floor Waterproofing
The designer must provide a waterproofing recommendation for approval by UNLV. Facilities suggested manufacturer: Neogard Pedigard II-fluid applied.

QUALITY CONTROL

During the design phase, the Consultant and UNLV will determine if a full-time waterproofing consultant is required during the construction phase to observe critical waterproofing operations.

Horizontal waterproofing surfaces with occupied space below must be flood-tested before backfilling or other overburden installation. To ensure that university property is not damaged during flood testing, the contractor must have personnel on-site during the entire flood test.

WARRANTY

Consultant to specify that the warranties must cover the entire cost of repairs or replacement of defective work during the warranty period, including the costs associated with exposing the waterproofing and replacing all materials. Facilities prefers a 10 year manufacturer warranty. (REV 02)

SECTION 07200

BUILDING INSULATION

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for concealed building insulation.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General
In general, miscellaneous metal items such as lintels, embeds, grating, ladders, bollards, stair nosings, trim and similar architectural features shall be designed and sized to meet codes and their applications.

QUALITY ASSURANCE

Source Limitations: Obtain each type of building insulation through one source.

Fire-Test-Response Characteristics: For exterior walls that are fire rated (south wall of Café Room 1261), provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

Surface-Burning Characteristics: ASTM E 84.
Fire-Resistance Ratings: ASTM E 119.
Combustion Characteristics: ASTM E 136.

Insulating Materials

Unfaced Mineral-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

Reflective Insulation: ASTM C 727-01 Standard Practice for use and installation of reflective insulation in building construction; ASTM C 1224-01 Standard specification for reflective insulation of building applications.

Insulations shall provide the following R-Values as a minimum:
R-19 at walls
R-30 at roofs and exposed floors

INSTALLATION GUIDELINES

Installation, General

Comply with insulation manufacturer's written instructions applicable to products and application indicated.

Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and water.

Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

Installation of General Building Insulation

Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:

Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.

Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

Installation of Reflective Insulation
Install reflective insulation directly on the concrete slab and walls of the second floor recessed computer floor area. Comply with the manufacturer’s recommendations for placement and attachment.

Protection

Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

SECTION 07500

DESIGN ANALYSIS FOR ROOF REPLACEMENT

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for the design analysis for roof replacement.

System Design and Performance Requirement

Obtain initial budget estimate for the project. Identify type of system to be used for replacement.

Contact manufacturers of system and request current updates to standard specification. Do not proceed without this information. Manufacturer's literature is changing several times per year with new and edited inserts.

Visit the site, photograph in color slide or digital camera, with close ups of all details, problem areas, HVAC installations, etc. Review design analysis form to identify all question answered at the site.

Answer all questions thoroughly. Put N/A in all non-applicable spaces.

Submit report to Executive Director of Planning Construction for review and approval.

University of Nevada, Las Vegas - Division of Facilities Management Box 451027, 4505 Maryland Pkwy., Las Vegas, NV 89154-1027 702.895.2500		
Design Analysis - Roof Replacment	Project Number	Project Title

PROJECT IDENTIFICATION

Building ________________________Specific Wing, Addition _______________________

Project Manager ____

Consultant(s) if required ______________________________________

Proposed Roofing System Manufacturer ______________________________________

GENERAL SCOPE OF PROPOSED WORK

Calendar for Work

Date for Substantial Completion	Date
Date on the Work begins	
60 day min. before Subset Compeletion	
Receive Bids	
45 day min. before start of the Work	
Advertisement for Bids	
21 day min. before Receiving Bids	
Complete Bid Documents and Submit	
to Director	
14 day min. before Advertisement for Bids	
Start Preparation of Bid Documents	
14 day min. before Complete Bid Documents	
and Submit to Director	
Preparation of Design Analysis	
21 day min. before Start Preparation of Bid Documents	

EXISTING CONDITIONS

Existing Drawings		
Title of Drawings		
Original Architect		
Original Structural Engineering		
Original Building Construction Date		
Last Roof Replacement	System	Date

EXISTING CONDITIONS

Environmental Conditions			
Roof Height Above Ground			
No. Of Stories			
Annual Temperature LOW HIGH		Avg. Jan. Temp.	Avg. July Temp.
Max. Snow Load (NWS)			
Snow load by UBC			
Maximum Wind Speed (NWS)			
UBC - Wind Uplift for Roof Slope		UBC - Wind Uplift for Corners	
Maximum Wind Load Allowed For Proposed System (for UL Class A and FM Class I approved systems)			

Harmful contaminants present: (OIL, KEROSENE, PETROLEUM PRODUCTS, ETC.) Note the presence of any of these is harmful to certain types of roofing systems. Confirm with manufacturer other harmful contaminants. Presence of any harmful contaminants or asbestos containing materials must be corrected (eliminated) in the scope of the Work. List:

Humidity level expected for interior spaces (evaluation of vapor barrier requirements):

STRUCTURAL CONDITIONS AND RECOMMENDATIONS

All aspects of existing and proposed conditions and ultimate recommendations must be under the signature and stamp of a registered structural engineer. The listed questions are only a starting point.

Original Structural Engineer:

Structural Engineer reviewing conditions:

Existing Structure		
Framing	Type: Condition:	
Decking	Type: Condition:	Thickness:
Repairs Required		
Movement Expected in Structure		
Other Conditions		
Loads	Live Load Design: Dead Load Design:	Actual Live Load: Actual Dead Load:
Effect of Proposed System on Loading Conditions		

Summary of Structural Recommendations:

Engineers Seal

____

Signature of Structural Engineering Date

ROOFING SYSTEM

Actual existing slope:

Proposed system slope limits:

Existing Roofing System	
Vapor Barrier: Type: Condition:	Insulation: Type: Condition:
Existing Roof R Value:	Thickness:
Roofing Type: Manufacturer:	Warranty: Date of Expiration:
Condition of Decking:	Corrections to Decking:
Condition of Insulation:	Corrections to Insulation:
Demolition Proposed:	Re-use Proposed:

Most insulation not only has lost its insulating value, but will also cause rust to metal decks and structural components and rotting to wood decks and structures. Insulation with even a small amount of moisture could cause trouble if a vapor barrier is present, or a mopping of bitumen was used to adhere original insulation. It will not dry from below. Remove entire system if moisture is present.

Proposed Roofing System	
Vapor Barrier: Type:	Insulation: Type:
New Roof R Value:	Thickness:
Roofing Type: Manufacturer:	Warranty:
Decking Preparation/Repairs:	Other Conditions:

Drainage - Existing	Gutters	Downspouts	Roof Drains	Scuppers
Area: SF				
Type				
Size				
Material				
Number				
Linear Feet				
Ponding (potential depth): Potential weight if all drains stopped up: Corrections anticipated:				

Drainage - New	Gutters	Downspouts	Roof Drains	Scuppers
Type				
Size				
Material				
Number				
Linear Feet				
Summary of Drainage Design:				

Fascias - Existing		Fascias - New	
Material		Material	
Color		Color	
Height		Height	
Anchorage		Anchorage	
Sub-Base		Sub-Base	
Drip		Drip	
Gravel Stop		Gravel Stop	
Summary Comments of Fascia System:			

Parapets (if any) Existing		Parapets- New Conditions	
Height		Height	
Thickness		Thickness	
Material		Material	
Coping Type and Sub-Base		Coping Type and Sub-Base	
Size		Size	
Anchorage		Anchorage	
Flashing		Flashing	
Summary Comments of Parapet System Repairs and Reconstruction:			

Reglets- (if any) Existing		Reglets- New Conditions	
Material		Material	
Wall Material		Wall Material	
Counter Flashing		Counter Flashing	
Height		Height	
Summary Comments of Reglet Repairs and Reconstruction:			

Expansion Joints - (if any) Existing (sketch or photograph)		Expansion Joints - New Conditions (draw detail of each proposed condition)	
Material		Material	
Width of Joint		Width of Joint	
Base Anchor		Base Anchor	
Condition		Condition	
Summary Comments of Expansion Joint Reconstruction:			

ROOF MOUNTED EQUIPMENT & ACCESSORIES

Existing Equipment (sketch or photograph details and layout)
HVAC Units: Number: Curb: Curb Height:
Pitch Pans: Number: Size: Height:
Wood Runners: Material Size: Supporting:
Ducts: Number: Size: Supporting:
Ventilators: Number: Curb: Size: Height:
Vents: Number: Height:
Skylights: Number: Size: Curb Height:
Walkways: Material: Length: Width:
Pipe Supports: Material: Length: Size of Pipe: Service:

ROOF MOUNTED EQUIPMENT & ACCESSORIES

Other Conditions or Equipment at Roof:

Proposed Conditions for Roof Mounted Equipment (provide all details)
HVAC Units: Material: Cant: Curb Height:
Pitch Pans: Number: Diameter: Height:
Wood Runners: Material: Size: Number: Length:
Duct Supports: Material: Size: Anchor:
Ventilator Curb Flashing: Material: Cant: Height:
Vent Flashing:
Skylight Flashing: Material: Curb Height:
Walkways: Material: Size: Length:
Pipe Supports: Material: Size:

SUMMARY OF PROPOSED BID DOCUMENTS, RATIONALE, AND BUDGET

Proposed Bid Document Package

Schematic Design Analysis By:
Drawings proposed (list):

System Proposed:

Specifications Sections; List all necessary specifications sections to be prepared for work in Division 2 through Division 16.

Justification for Recommended System

Weight:

Appearance:

Reflective/Energy Conservation:

Cost:

Insulation:

Thickness:

Warranty:

Other:

Some materials are incompatible with other existing and other new materials. Has clearance from manufacturer of all proposed components been approved as compatible for each other and actual site conditions?

Complete all previous questions before completing this table. Attach itemized breakdowns of all estimated costs, including Consultant services.
Roof Area
Structural Work
Mechanical Work
Masonry Work
Other Work
Consultant Fees, Testing
Subtotal
Project Contingency (10% of subtotal)

STATEMENT OF BUDGET, TOTAL:

Design Analysis Prepared by Date

Approved by Director, Planning and Construction Date

SECTION 07542

POLYVINYL-CHLORIDE (PVC) ROOFING

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SUMMARY

Install a new 60 mil PVC (Polyvinyl Chloride) membrane with factory laminated felt backing mechanically-attached with flashings and other components to comprise a roofing system as follows. This included general design criteria for both re-roofing and new roof construction.

Related Work

The work includes but is not necessarily limited to the installation of:

- Substrate Preparation
- Roof Drains
- Wood Blocking
- Roof Membrane
- Fasteners
- Adhesive for Flashings
- Roof Membrane Flashings
- Separation Board
- Walkways
- Metal Flashings
- Sealant

BIDDING REQUIREMENTS

Pre-Bid Meeting
A pre-bid meeting shall be held with the Owner's Representative and involved trades to discuss all aspects of the project. The Applicator's field representative or roofing foreman for the work shall be in attendance. Procedures to avoid rooftop damage by other trades shall be determined. Meeting time and place are to be set by the Owner.

Site Visit
Bidders shall visit the site and carefully examine the areas in question as to conditions that may affect proper execution of the work. All dimensions and quantities shall be determined or verified by the contractor. No claims for extra costs will be allowed because of lack of full knowledge of the existing conditions unless agreed to in advance with the Owner or Owner's Representative.

Pre-Construction Conference

The Applicator, Owner's Representative/Designer and PVC Membrane Manufacturer(s) shall attend a pre-construction conference. Time and Date to be determined the owner.

The meeting shall discuss all aspects of the project including but not limited to:

- Safety
- Set up
- Construction schedule
- Contract conditions

- Coordination of the work

System Design and Performance Requirements
The applicator shall submit evidence that the proposed roof system meets the requirements of the local building code and has been tested and approved or listed by the following test organizations. These requirements are minimum standards and no roofing work shall commence without written documentation of the system's compliance:
- Underwriters Laboratories, Inc. - Northbrook, IL
- Class A assembly
- Factory Mutual Research Corporation (FM)
- Class 1-90

SUBMITTALS

All submittals which do not conform to the following requirements will be rejected.

Submittals

A list of each primary component to be used in the roof system and the Manufacturer's current literature for each component:
- Sample copy of Roofing Manufacturer's warranty.
- Sample copy of Contractor's warranty.
- Letter from Roofing Manufacturer confirming that the Contractor is an authorized applicator of the specified roof system.

SUBMITTALS OF EQUALS

Submit proposed equals to be considered for use on this project no less than ten (10) days prior to bid date. Proposed roof systems which have been reviewed and accepted will be listed in an addendum prior to bid date; only then will roof systems be accepted at bidding. Submittals of equals shall include the following:
- Copies of Specification including physical properties.
- Samples of each primary component to be used in the roof system and the manufacturer's current literature for each component.
- Written approval by the insulation manufacturer (as applicable) for use and performance of the product in the proposed system.
- Sample copy of Manufacturer's warranty including no exclusion for ponding water without time limit.
- Sample copy of Applicator's/Contractor's warranty.
- Certifications by manufacturers of roofing and insulating materials that all materials supplied comply with all requirements of the identified ASTM and industry standards or practices and requirements of this specification as stated in Section 2.01, C & D.
- Certification from the Applicator that the system specified meets all identified code and insurance requirements as required by the Specification.
- Letter from the proposed manufacturer confirming the number of years it has DIRECTLY manufactured the proposed roof system under the trade names and/or trademarks as proposed. Note: Membrane products with Evaloy of KEE additives will not be accepted or reviewed. (REV 02)
- Material Safety Data Sheets (MSDS)

PRODUCT STANDARDS

The components of the PVC mechanically-attached roof system are to be products of Sika Sarnafil or approved equal as indicated on the Detail Drawings and specified in the Contract Documents provided by the Owner.

Components to be used that are other than those supplied or approved by PVC manufacturer may be submitted for review and acceptance by PVC manufacturer. PVC manufacturer's acceptance of any other product is only for a determination of compatibility with approved PVC products and not for inclusion in the manufacturer's warranty. The specifications, installation instructions, limitations, and/or restrictions of the respective manufacturers must be reviewed by the Owner's Representative for acceptability for the intended use with approved PVC manufacturer's products.

Membrane shall be certified by the manufacturer to be within two (2) mils of the specified membrane thickness as stated in this section. ASTM minimum requirements will not be accepted.

MATERIALS

Membrane
60 mil PVC Manufacturer shall be Sika Sarnafil® S327 polyester reinforced feltback membrane with an integral factory-applied lacquer coating to repel dirt and sustain reflectivity:

- Membrane shall conform to ASTM D4434-96 (or latest revision), "Standard for Polyvinyl Chloride Sheet Roofing," Classification: Type II, Grade I.
- PVC membrane shall be Sika Sarnafil S327-15, 60 mil (1.5 mm), thermoplastic membrane with polyester reinforcement with a factory applied 9 oz. geotextile felt backing. Or approved Equal.
- Color of Membrane
  EnergySmart (white), initial reflectivity of 0.83, initial emissivity 0.90, solar reflective index (SRI) of >104. (Determined by the EPA's Energy Star Products Program and Cool Roof Materials Database).

Typical Physical Properties

Parameters	ASTM Test Method	Minimum ASTM Requirement	Sarnafil Typical Physical Properties
Reinforcing Material	-		Polyester
Overall Thickness, min., inches (mm)	D751	0.060	[0.060 inches]
Breaking Strength, min., lbf/in. (KN/m)	D751	200 (35.0)	230 (40.0)
Elongation at Break, min.	D751	15%	20%
Seam strength*, min. (% of breaking strength)	D751	75	85
Retention of Properties After Heat Aging	D3045	-	-
Breaking Strength, min., (% of original)	D751	90	95
Elongation, min., (% of original)	D751	90	90
Tearing Strength, min., lbf (N)	D1004	45.0 (200)	50 (220)
Low Temperature Bend, -40°F (-40°C)	D2136	Pass	Pass
Accelerated Weathering Test (Xenson Arc)	D2565	5,000 Hours	10,000 Hours
Cracking (7x magnification)	-	None	None
Discoloration (by observation)	-	Negligible	Negligible
Crazing (7 x magnification)	-	None	None
Linear Dimensional Change	D1204	0.5% max.	0.1%
Weight Change After Immersion in Water	D570	+ 3.0% max.	2.5%
Static Puncture Resistance, 33 lbf (15 kg)	D5602	Pass	Pass
Dynamic Puncture Resistance, 14.7 ft-lbf (20 J)	D5635	Pass	Pass

*Failure occurs through membrane rupture not seam failure. Physical Properties shown are prior to applying feltbacked, if specified.

Flashing Materials
Wall/Curb Flashing:
PVC Flashing Membrane

- A fiberglass reinforced membrane adhered to approved substrate using adhesive.

- PVC Asphalt Resistant Flashing Membrane
- An asphalt-resistant, fiberglass reinforced membrane adhered to approved substrate using adhesive.

PVC Mechanically Attached Flashing Membrane

- A polyester reinforced membrane used for mechanically-attached flashings to approved substrate using disc or bar.

PVC Clad Metal

- A PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. Clad Metal is a 25 gauge, G90 galvanized metal sheet with a 20 mil (1 mm) unsupported PVC membrane laminated on one side. The dimensions of clad metal are 4 ft x 8 ft (1.2 m x 2.4 m) or 4 ft x 10 ft (1.2 m x 3.0m).

Perimeter Edge Flashing
PVC Clad Metal

- A PVC-coated, heat-weldable sheet metal capable of being formed into a variety of shapes and profiles. Clad Metal is a 25 gauge, G90 galvanized metal sheet with a 20 mil (1 mm) unsupported PVC membrane laminated on one side. The dimensions of clad metal are 4 ft x 8 ft (1.2 m x 2.4 m) or 4 ft x 10 ft (1.2 m x 3.0m).

Non-Typical Edge

- Project-specific perimeter edge detail reviewed and accepted for one-time use by Manufacturer's Technical Department. Consult Regional Technical Manager prior to job start for review and consideration for acceptance.

Separation Board
Dens-Deck Prime®

- A siliconized gypsum, fire-tested hardboard with glass-mat facers and pre-primed surface of one side. Dens-Deck Prime is provided in a 4 ft x 8 ft (1.2 m x 2.4 m) board size and in thickness of 1/2 inch.

Attachment Components
Insulation Plate

- Used with various fasteners to attach insulation boards to roof deck. Insulation plate is a 3 inch (75 mm) square or round, 26 gauge stamping of SAE 1010 steel with an AZ 55 Galvalume coating.

Insulation Fastener #12

- A #12 corrosion-resistant fastener used with plates to attach insulation boards to steel or wood roof decks. Fastener #12 has a modified buttress thread, a shank diameter of approximately 0.168 inch (4 mm) and a thread diameter of approximately 0.214 inch (5 mm). The driving head has a diameter of approximately 0.435 inch (11 mm) with a #3 Phillips recess for positive engagement.

Membrane Fastener-XP

- A #15, heavy-duty, corrosion-resistant fastener used with plate to attach insulation or disc, disc-XPN and bar to attach Sarnafil S327 roof membrane to steel or wood roof decks. Fastener-XP has a shank diameter of approximately 0.21 inch (5.3 mm) and the thread diameter is approximately 0.26 inch (6.6 mm). The driving head has a diameter of approximately 0.435 inch (11 mm) with a #3 Phillips recess for positive engagement.

Fastener-MAXLoad

- A specially designed, heavy-duty, corrosion-resistant fastener used with the polymeric batter strip to clamp PVC roof membrane to steel roof decks. Fastener-MAXLoad has a shank diameter of approximately 0.26 inch (6.6 mm) and a thread diameter of approximately 0.33 inch (8.4 mm). The driving head has a diameter of approximately 0.66 inch (16.8 mm) with a #3 Phillips recess for positive engagement and simplicity of application.

Membrane Disc-XPN

- A high strength linear plate used with a fastener to attach PVC roof membrane to steel, wood or concrete roof decks. Disc-XPN is an 18 gauge (1.2 mm), 1½ inch by 3¾ inch (38 mm x 95 mm) corrosion resistant steel plate.

Membrane Disc-XPS

- A high strength linear plate used with fastener–XPS to attach PVC roof membrane to steel roof decks. Disc-XPS is an 18 gauge (1.2 mm), 2 inch by 31/4 inch (50 x 82 mm) corrosion resistant steel plate.

Walkway Protection

Tread

- A polyester reinforced, 0.096 inch (96 mil/2.4 mm), weldable PVC membrane with surface embossment. Used as a protection layer from rooftop traffic. Tread is supplied in rolls of 39.3 inches (1.0 m) wide and 32.8 feet (10 m) long.

Miscellaneous Accessories

Aluminum Tape

- A 2 inch (50 mm) wide pressure-sensitive aluminum tape used as a separation layer between small areas of asphalt contamination and the membrane and as a bond-breaker under the coverstrip at Clad joints.

Miscellaneous Fasteners and Anchors

- All other fasteners, anchors, nails, straps, bars, etc. shall be post-galvanized steel, aluminum or stainless steel. Mixing metal types and methods of contact shall be assembled in such a manner as to avoid galvanic corrosion. Fasteners for attachment of metal to masonry shall be expansion type fasteners with stainless steel pins. All concrete fasteners and anchors shall have a minimum embedment of 1¼ inch (32 mm) and shall be approved for such use by the fastener manufacturer. All miscellaneous wood fasteners and anchors used for flashings shall have a minimum embedment of 1 inch (25 mm) and shall be approved for such use by the fastener manufacturer.

Related Materials

Wood Nailer (if required)

- Treated wood nailers shall be installed at the perimeter of the entire roof and around such other roof projections and penetrations as specified on Project Drawings. Thickness of nailers must match the insulation thickness to achieve a smooth transition. Wood nailers shall be treated for fire and rot resistance (wolmanized or osmose treated) and be #2 quality or better lumber. Creosote or asphalt-treated wood is not acceptable. Wood nailers shall conform to Factory Mutual Loss Prevention Data Sheet 1-49. All wood shall have a maximum moisture content of 19% by weight on a dry-weight basis.

Plywood (if required)

- When bonding directly to plywood, a minimum 5/8 inch (12 mm) CDX (C side out), smooth-surfaced exterior grade plywood with exterior grade glue shall be used. Rough-surfaced plywood or high fastener heads will require the use of Felt behind the flashing membrane. Plywood shall have a maximum moisture content of 19% by weight on a dry weight basis.

INSTALLATION GUIDELINES

Remove existing SINGLE PLY roof system flashings from curbs, walls and mechanical units specified by the owner at the time of the mandatory job walk and prepare to receive new asphalt resistant 60 mil membrane flashing. Install new flashing per manufacturer's recommended detail and installation requirements.

Install new PVC 60 Mil membrane w/factory laminated felt backing by mechanical attachment (see following specification) over the existing single ply roof system currently in place into the existing metal deck. Install new PVC membrane per the manufacturer's standard and detail requirements.

Remove all pitch pockets and re-flash each pipe penetration per the approved PVC manufacturer's standard details.

Flash each curb under existing counter-flashing and add extender piece as necessary.

Flash each pipe penetration with cone flashing membrane per approved PVC membrane manufacturer's standard and detail requirement.

Install new clad edge metal at all edge conditions and weld (per enclosed specification and approved membrane manufacturer's requirements) field sheet to clad edge metal.

Remove and dispose of all existing wood sleepers and Install new redwood sleepers at the same locations per the membrane manufacture's standard and detail requirements .

Flash all scuppers per the approved PVC manufacturer's installation and standard details.

At internal scupper/drain location with laminated PVC membrane, install new vertical drain insert manufactured by Olympic. Install per manufacturer's requirements.

At all antennae locations, install new eye-hood supports into the existing metal deck and re-install all guide wires per the owners directions.

At sloped perimeter – At base of slope, remove and dispose of approximately 12" high up the slope down to the existing metal framing and install new 5/8 " fire treated plywood and attach to the existing metal framing. Install new plywood per all local building codes.

At sloped perimeter – Install new layer of ¼" Dens Deck Prime and over the existing single ply membrane and newly installed plywood. Mechanically attach with #12 fastener and approved insulation plate through the existing single ply and 5/8" gypsum board and into existing metal framing. Install new layer of 60 mil PVC membrane to the new Dens Deck Prime with approved manufacturer's flashing adhesive. Install new PVC membrane per the approved PVC manufacturer's recommended detail and installation requirements.

QUALITY ASSURANCE

This roofing system shall be applied only by a Roofing Contractor authorized by approved PVC membrane manufacturer prior to bid. The Roofing Contractor shall have at least five (5) years of experience as an
applicator with the submitted manufacturer as certified in writing by the manufacturer.

Upon completion of the installation and the delivery to PVC membrane manufacturer by the Applicator of a certification that all work has been done in strict accordance with the contract specifications and manufacturer's requirements, an inspection shall be made by a Technical Representative of PVC membrane manufacture to review the installed roof system.

There shall be no deviation made from the Project Specification or the approved shop drawings without prior written approval by the Owner, the Owner's Representative and approved manufacturer.

All work pertaining to the installation of PVC membrane and flashings shall only be completed by Applicator personnel trained and authorized by PVC membrane manufacturer in those procedures.

PVC Membrane to have no formulation changes in the last fifteen (15) years as certified in writing by the manufacturer.

PVC membrane manufacturer must directly produce their product, no private labeled products/membranes will be accepted.

Approved Roofing Applicator must provide proof that they have an operating office within 25 miles of the site. Office must have been in business and have current City of Las Vegas, Clark County or Henderson business licenses for a minimum of one (1) year.

Product Delivery, Storage, and Handling

All products delivered to the job site shall be in the original unopened containers or wrappings bearing all seals and approvals.

Handle all materials to prevent damage. Place all materials on pallets and fully protect from moisture.

Membrane rolls shall be stored lying down on pallets and fully protected from the weather with clean canvas tarpaulins or approved other means. Unvented polyethylene tarpaulins are not accepted due to the accumulation of moisture beneath the tarpaulin in certain weather conditions that may affect the ease of membrane weldability.

All adhesives shall be stored at temperatures between 40º F (5º C) and 80º F (27º C).

All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow precautions outlined on containers or supplied by material manufacturer/supplier.

All materials which are determined to be damaged by the Owner's Representative or PVC membrane manufacturer are to be removed from the job site and replaced at no cost to the Owner.

Job Conditions

Approved manufacturer's materials may be installed under certain adverse weather (to be determined by the owner and applicator at time of installation) conditions but only after consultation with approved manufacturer, as installation time and system integrity may be affected.

Only as much of the new roofing as can be made weathertight each day, including all flashing and detail work, shall be installed. All seams shall be cleaned and heat welded before leaving the job site that day.

All work shall be scheduled and executed without exposing the interior building areas to the effects of inclement weather. The existing building and its contents shall be protected against all risks.

All surfaces to receive new insulation, membrane or flashings shall be dry. Should surface moisture occur, the Applicator shall provide the necessary equipment to dry the surface prior to application.

All new and temporary construction, including equipment and accessories, shall be secured in such a manner as to preclude wind blow-off and subsequent roof or equipment damage.

Uninterrupted waterstops shall be installed at the end of each day's work and shall be completely removed before proceeding with the next day's work. Waterstops shall not emit dangerous or unsafe fumes and shall not remain in contact with the finished roof as the installation progresses. Contaminated membrane shall be replaced at no cost to the Owner.

The Applicator is cautioned that certain PVC membranes are incompatible with asphalt, coal tar, heavy oils, roofing cements, creosote and some preservative materials. Such materials shall not remain in contact with Sarnafil membranes. The Applicator shall consult PVC manufacturer regarding compatibility, precautions and recommendations.

Arrange work sequence to avoid use of newly constructed roofing as a walking surface or for equipment movement and storage. Where such access is absolutely required, the Applicator shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas. A substantial protection layer consisting of plywood over felt or plywood over insulation board shall be provided for all new and existing roof areas that receive rooftop traffic during construction.

Prior to and during application, all dirt, debris and dust shall be removed from surfaces either by vacuuming, sweeping, blowing with compressed air and/or similar methods.

The Applicator shall follow all safety regulations as required by OSHA and any other applicable authority having jurisdiction.

All roofing, insulation, flashings and metal work removed during construction shall be immediately taken off site to a legal dumping area authorized to receive such materials. Hazardous materials, such as materials containing asbestos, are to be removed and disposed of in strict accordance with applicable City, State and Federal requirements.

All new roofing waste material (i.e., scrap roof membrane, empty cans of adhesive) shall be immediately removed from the site by the Applicator and properly transported to a legal dumping area authorized to receive such material.

The Applicator shall take precautions that storage and/or application of materials and/or equipment does not overload the roof deck or building structure.

Installation of a PVC membrane over coal tar pitch or a resaturated roof requires special consideration to protect the PVC membrane from volatile fumes and materials. Consult PVC manufacturer for precautions prior to bid.

Flammable adhesives shall not be stored and not be used in the vicinity of open flames, sparks and excessive heat.

All rooftop contamination that is anticipated or that is occurring shall be reported to PVC manufacturer to determine the corrective steps to be taken.

The Applicator shall verify that all roof drain lines are functioning correctly (not clogged or blocked) before starting work. Applicator shall report any such blockages in writing (letter copy to PVC manufacturer) to the Owner's Representative for corrective action prior to installation of the PVC roof system.

Applicator shall immediately stop work if any unusual or concealed condition is discovered and shall immediately notify Owner of such condition in writing for correction at the Owner's expense (letter copy to Sarnafil).

Site cleanup, including both interior and exterior building areas that have been affected by construction, shall be completed to the Owner's satisfaction.

All landscaped areas damaged by construction activities shall be repaired (to the satisfaction of the PVC manufacturer and owner) at no cost to the Owner.

The Applicator shall conduct fastener pullout tests in accordance with the latest revision of the SPRI/ANSI Fastener Pullout Standard to help verify condition of deck/substrate and to confirm expected pullout values. Pull out test are to be done prior to start of the project and results are to be sent to the PVC manufacturer for approval.

The PVC mechanically-attached membrane shall not be installed under the following conditions without consulting PVC Manufacturer Technical for precautionary steps:

The roof assembly permits interior air to pressurize the membrane underside.

Any exterior wall has 10% or more of the surface area comprised of opening doors or windows.

The wall/deck intersection permits air entry into the wall flashing area.

Precautions shall be taken when using adhesives at or near rooftop vents or air intakes. Adhesive odors could enter the building. Coordinate the operation of vents and air intakes in such a manner as to avoid the intake of adhesive odor while ventilating the building. Keep lids on unused adhesive cans at all times.

Protective wear shall be worn when using solvents or adhesives or as required by job conditions.

Substrate Inspection

A dry, clean and smooth substrate shall be prepared to receive the mechanically-attached roof system.

The Applicator shall inspect the substrate for defects such as excessive surface roughness, contamination, structural inadequacy, or any other condition that will adversely affect the quality of work.

The substrate shall be clean, smooth, dry, free of flaws, sharp edges, loose and foreign material, oil and grease. Roofing shall not start until all defects have been corrected.

All roof surfaces shall be free of water, ice and snow.

Membrane shall be applied over compatible and accepted substrates only.

Installation of PVC Membrane

The surface of the insulation or substrate shall be inspected prior to installation of the PVC roof membrane. The substrate shall be clean, dry, free from debris and smooth with no surface roughness or contamination. Broken, delaminated, wet or damaged insulation boards shall be removed and replaced.

General

PVC membrane is to be attached with fasteners and bar according to PVC Manufacturer's requirements.

Membrane overlaps shall be shingled with the flow of water where possible.

PVC membrane full-width (120 inch) rolls shall be fastened perpendicular to the direction of the steel deck flutes, wood plank, precast or cementitious wood fiber panel where possible.

Tack welding of PVC full or half-width rolls for purposes of temporary restraint during installation is not permitted. Consult Manufacturer's Technical Department for further information.

Perimeter and Corner Areas

Over the properly installed and prepared substrate surface, PVC membrane half-width (60 inches) rolls are to be installed parallel with the entire perimeter edge. The number of adjacent half-rolls will be determined by building height and width and other conditions according to PVC Manufacturer's Technical. Fasteners and discs are installed along the edge of the membrane on the fastening line at a spacing determined by pvc manufacturer and the Owner's Representative/Designer. Discs are held-back 1 inch (25 mm) from the outer edge of the membrane. The adjacent half-roll is positioned to overlap the fastened edge of the first half-roll by 5-1/2 inches (140 mm) in accordance with the overlap lines marked on it's edge. The 5-1/2 inch (140 mm) overlap will allow the top membrane to extend 2-1/2 inches (63 mm) past the discs for heat-welding. Fasteners shall clamp the PVC membrane tightly to the substrate.

In corner areas where perimeter half-rolls intersect, add rows of fasteners and discs over the top the half-rolls and weld a (PVC) coverstrip above them for watertightness. See Detail Drawings.

Notes:

Perimeter area is defined as the outer boundary of the roof. If the roof is broken into different levels, each roof area shall be treated as an individual roof with its outer boundary being treated as a perimeter. Typically, internal expansion joints and firewalls are not considered to be full perimeters.

The ridge area is defined as the high point in the roof area formed by two intersecting planes. When the sum of the slopes is a minimum of 4 inches in 12 inches (30 degrees), each side of the ridge shall be treated as a perimeter area.

Hot-air weld overlaps according to manufacturer’s requirements. Seam test cuts shall be taken at least 3 times per day.

Interior Area

Over the properly installed and prepared substrate surface, S327 full-width (120 inches) rolls are to be installed perpendicular to the steel deck flutes, wood plank or wood or concrete panels. Fasteners and discs are installed along the edge of the membrane on the fastening line at a spacing determined by manufacturer and the Designer. Discs are held-back 1 inch (25 mm) from the outer edge of the membrane. The adjacent full-roll is positioned to overlap the fastened edge of the first full-roll by 5-1/2 inches (140 mm) in accordance with the overlap lines marked on it’s edge. The 5-1/2 inch (140 mm) overlap will allow the top membrane to extend 2-1/2 inches (63 mm) past the discs for heat-welding. Fasteners shall clamp the PVC membrane tightly to the substrate.

Hot-air weld overlaps according to Manufacturer’s recommendations. Seam test cuts shall be taken at least 3 times per day.

Securement Around Rooftop Penetrations

Around all perimeters, at the base of walls, drains, curbs, vent pipes, or any other roof penetrations, Fasteners and discs shall be installed according to perimeter rate of attachment. Fasteners shall be installed according to the manufacturer’s instructions. Fasteners shall be installed using the fastener manufacturer’s recommended torque-sensitive fastening tools with depth locators. Fasteners shall clamp the Sarnafil membrane tightly to the substrate.

PVC membrane flashings shall extend 2-1/2 inches (63 mm) past the discs and be hot-air welded to the Sarnafil deck membrane.

Hot-Air Welding of Seam Overlaps

General

All seams shall be hot-air welded. Seam overlaps should be 3 inches (75 mm) wide when automatic machine-welding and 4 inches (100 mm) wide when hand-welding, except for certain details which may occur.

Welding equipment shall be provided by or approved by PVC Manufacturer. All mechanics intending to use the equipment shall have successfully completed a training course provided by a PVC Manufacturer Technical Representative prior to welding.

All membrane to be welded shall be clean and dry.

Hand-Welding

Hand-welded seams shall be completed in two stages. Hot-air welding equipment shall be allowed to warm up for at least one minute prior to welding.

The back edge of the seam shall be welded with a narrow but continuous weld to prevent loss of hot air during the final welding.

The nozzle shall be inserted into the seam at a 45 degree angle to the edge of the membrane. Once the proper welding temperature has been reached and the membrane begins to "flow," the hand roller is positioned perpendicular to the nozzle and pressed lightly. For straight seams, the 1½ inch (40 mm) wide nozzle is recommended for use. For corners and compound connections, the ¾ inch (20 mm) wide nozzle shall be used.

Machine Welding

Machine welded seams are achieved by the use of automatic welding equipment. When using this equipment, Sarnafil's instructions shall be followed and local codes for electric supply, grounding and over current protection observed. Dedicated circuit house power or a dedicated portable generator is recommended. No other equipment shall be operated off the generator.

Metal tracks may be used over the deck membrane and under the machine welder to minimize or eliminate wrinkles.

QUALITY CONTROL OF WELDED SEAMS

The Applicator shall check all welded seams for continuity using a rounded screwdriver. Visible evidence that welding is proceeding correctly is smoke during the welding operation, shiny membrane surfaces, and an uninterrupted flow of dark gray material from the underside of the top membrane. On-site evaluation of welded seams shall be made daily by the Applicator to locations as directed by the Owner's Representative or Manufacturer's representative. One inch (25 mm) wide cross-section samples of welded seams shall be taken at least three times a day. Correct welds display failure from shearing of the membrane prior to separation of the weld. Each test cut shall be patched by the Applicator at no extra cost to the Owner.

Membrane Flashings
All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and PVC Manufacturer. Approval shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing, the affected area shall be removed and replaced at the Applicator's expense. Flashing shall be adhered to compatible, dry, smooth, and solvent-resistant surfaces. Use caution to ensure adhesive fumes are not drawn into the building.

Adhesive for PVC Membrane Flashings

Over the properly installed and prepared flashing substrate, adhesive shall be applied according to instructions found on the Product Data Sheets provided by the PVC manufacturer. The approved adhesive shall be applied in smooth, even coats with no gaps, globs or similar inconsistencies. Only an area which can be completely covered in the same day's operations shall be flashed. The bonded sheet shall be pressed firmly in place with a hand roller.

No adhesive shall be applied in seam areas that are to be welded. All panels of membrane shall be applied in the same manner, overlapping the edges of the panels as required by welding techniques.

PVC manufacturer's requirements and recommendations and the specifications shall be followed. All material submittals shall have been accepted by approved manufacturer prior to installation.

All flashings shall extend a minimum of 8 inches (0.2 m) above roofing level unless otherwise accepted in writing by the Owner's Representative and PVC Manufacturer’s Technical Department.

All flashing membranes shall be consistently adhered to substrates. All interior and exterior corners and miters shall be cut and hot-air welded into place. No bitumen shall be in contact with the Sarnafil membrane.

All flashing membranes shall be mechanically fastened along the counter-flashed top edge with peel-stop at 6-8 inches (0.15-0.20 m) on center.

PVC flashings shall be terminated according to PVC manufacturer recommended details.

All adhered flashings that exceed 30 inches (0.75 m) in height or that of the perimeter bar spacings shall receive additional securement. Consult PVC Manufacturer’s Technical Department for securement methods.

All mechanically-attached flashings that exceed 18 inches (0.46 m) in height shall receive additional securement. Consult Manufacturer’s Technical Department for securement methods.

Sarnaclad Metal Base Flashings/Edge Metal
All flashings shall be installed concurrently with the roof membrane as the job progresses. No temporary flashings shall be allowed without the prior written approval of the Owner's Representative and PVC manufacturer. Acceptance shall only be for specific locations on specific dates. If any water is allowed to enter under the newly completed roofing due to incomplete flashings, the affected area shall be removed and replaced at the Applicator's expense.

Clad metal flashings shall be formed and installed per the Detail Drawings.

All metal flashings shall be fastened into solid wood nailers with two rows of post galvanized flat head annular ring nails, 4 inches (100 mm) on center staggered. Fasteners shall penetrate the nailer a minimum of 1 inch (25 mm).

Metal shall be installed to provide adequate resistance to bending and allow for normal thermal expansion and contraction.

Adjacent sheets of clad metal shall be spaced ¼ inch (6 mm) apart. The joint shall be covered with 2 inch (50 mm) wide aluminum tape. A 4 inch minimum (100 mm) wide strip of PVC flashing membrane shall be hot-air welded over the joint.

Walkway Installation

PVC Tred Walkway
Roofing membrane to receive Tred Walkway shall be clean and dry. Place chalk lines on deck sheet to indicate location of Walkway. Apply a continuous coat of approved adhesive (provided by approved PVC manufacturer) to the deck sheet and the back of Walkway in accordance with PVC manufacturer's technical requirements and press Walkway into place with a water-filled, foam-covered lawn roller. Clean the deck membrane in areas to be welded. Hot-air weld the entire perimeter of the Walkway to the PVC deck sheet. Check all welds with a rounded screwdriver. Re-weld any inconsistencies. Important: Check all existing deck membrane seams that are to be covered by Walkway with rounded screwdriver and reweld any inconsistencies before Walkway installation.

Temporary Cut-Off

All flashings shall be installed concurrently with the roof membrane in order to maintain a watertight condition as the work progresses. All temporary waterstops shall be constructed to provide a 100% watertight seal. The stagger of the insulation joints shall be made even by installing partial panels of insulation. The new membrane shall be carried into the waterstop. The waterstop shall be sealed to the deck and/or substrate so that water will not be allowed to travel under the new or existing roofing. The edge of the membrane shall be sealed in a continuous heavy application of sealant as described in this section. When work resumes, the contaminated membrane shall be cut out. All sealant, contaminated membrane, insulation fillers, etc. shall be removed from the work area and properly disposed of off site. None of these materials shall be used in the new work.

If inclement weather occurs while a temporary waterstop is in place, the Applicator shall provide the labor necessary to monitor the situation to maintain a watertight condition.

If any water is allowed to enter under the newly-completed roofing, the affected area shall be removed and replaced at the Applicator's expense.

Substrate Condition

Applicator shall be responsible for acceptance or provision of proper substrate to receive new roofing materials.

Applicator shall verify that the work done under related sections meets the following conditions:

Roof drains and/or scuppers have been reconditioned and/or replaced and installed properly.

Roof curbs, nailers, equipment supports, vents and other roof penetrations are properly secured and prepared to receive new roofing materials.

All surfaces are smooth and free of dirt, debris and incompatible materials.

All roof surfaces shall be free of water, ice and snow.

Substrate Preparation
The roof deck and existing roof construction must be structurally sound to provide support for the new roof system. The Applicator shall load materials on the rooftop in such a manner to eliminate risk of deck overload due to concentrated weight. The Owner's Representative shall ensure that the roof deck is secured to the structural framing according to local building code and in such a manner as to resist all anticipated wind loads in that location.

Re-roofing Over Existing Single Ply Roof System
The owners representative and applicator shall determine the condition of the roof deck and existing insulation. Deteriorated decking or wet or deteriorated materials are to be removed and replaced. Install new layer of approved PVC felt back membrane and mechanically attach per manufacturer's recommended detail and installation requirements.

WARRANTY

Upon successful completion of work the following warranties may be obtained:

Manufacturer's Warranty – 20 Years "No Dollar Limit" (see section 1.08 for definition) (REV 02)

Roofing Contractor Warranty – 5 Year

PVC Manufacturer's Standard Warranty (only products purchased from approved PVC manufacturer are

covered under Standard Warranty)
Upon successful completion of the work to the Roofing Manufacturer's and Owner’s satisfaction, and receipt of final payment, the fifteen (15) Year Standard Warranty shall be issued. The Standard Warranty shall provide for the roof membrane, all accessories that comprise a roof system, and contractor labor. The Warranty shall be Non-Prorated provide for 20 years No Dollar Limit (NDL), and shall not exclude ponding water and no time limited shall be assigned for any such ponding water during the warranty period. (REV 02)

Applicator/Roofing Contractor Warranty

The Applicator shall supply the Owner with a separate five-year workmanship warranty. In the event any work related to roofing, flashing, or metal is found by the PVC manufacturer to be within the Applicator warranty term, defective or otherwise not in accordance with the Contract Documents, the Applicator shall repair that defect at no cost to the Owner. The Applicator's warranty obligation shall run directly to the Owner, and a copy shall be sent to PVC Membrane Manufacturer. (REV 02)

Owner Responsibility
Owner shall notify both Manufacturer and the Applicator of any leaks as they occur during the time period when both warranties are in effect.

Completion

Prior to demobilization from the site, the work shall be reviewed by the wner's Representative and the Applicator. All defects noted and non-compliances with the Specifications or the recommendations of Sarnafil shall be itemized in a punch list. These items must be corrected immediately by the Applicator to the satisfaction of the Owner's Representative and PVC Manufacturer prior to demobilization.

All Warranties referenced in this Specification shall have been submitted and have been accepted at time of contract award.

SECTION 07600

FLASHING AND SHEET METAL

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for flashing systems and sheet metal on roof systems; as well as formed reglets.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General

Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress because of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior. Designer shall not avoid relying solely on sealants as the sole source of prohibiting water intrusion.

Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

MATERIALS

Specify minimum 24-gauge thickness for galvanized metal, and identify specific heavier gauges where the project requires.

-OR-

Specify minimum 16 ounce for copper, and identify specific heavier materials where the project requires.

Use only minimum 16 ounce copper for masonry through-wall, lintel, or other similar embedded flashings.

Use only 4 pound lead for roof drain sump pans.

When necessary, use 4 pound lead for flashings involving compound curves or where sheetmetal can not be adequately formed. This application requires a galvanized sheet metal protective cover.

Where 2-piece reglets are required, describe the specific shape and substrate conditions, but do not reference proprietary manufacturer's products.

Do not specify roof jacks or boots which utilize integral neoprene seals.

Use only galvanized structural steel tube or pipe for downspout sections which are subject to impact and abuse.

Specify only 50/50 tin/lead solder when applicable.

Specify only non-corrosive fasteners, same material as metal being fastened, with matching finish on exposed heads. Specify neoprene-backed washers for screw fasteners.

INSTALLATION GUIDELINES

General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

Torch cutting of sheet metal flashing and trim is not permitted.

Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

Coat side of uncoated aluminum, stainless-steel and sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.

Underlayment: Where installing metal flashing directly on cementitious or wood

substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.

Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

Wall Flashing Installation
General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

Miscellaneous Flashing Installation
Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

SECTION 07811

FIREPROOFING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for sprayed fire-resistive materials applied to surfaces concealed from view.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

The consultant shall indicate on the drawings, the UL Listing Number and show the UL system be listed for each condition of structural fireproofing.

Fireproofing systems which are part of a renovation project (e.g. repair of damaged or missing systems, or removal and replacement of existing systems) should follow these standards. Existing fire resistance ratings must not be compromised. The consultant must prepare a complete specification and details for the required repair work. Generic "repair fireproofing as required" notes are not acceptable.

This is a section where the Consultant should use a "performance specification". Do not specify proprietary flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

SUBMITTALS

Product Data: For each product indicated.

Shop Drawings: Show extent of sprayed fire-resistive material for each construction and fire-resistance rating, applicable fire-resistive design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction, and minimum thicknesses.

Compatibility and adhesion test reports.

PRODUCT STANDARDS

Products
No asbestos containing materials will be permitted.

Concealed Strayed Fire-Resistive Materials

General: For concealed applications of sprayed fire-resistive materials, provide manufacturer's standard products complying with requirements indicated for material composition and physical properties representative of installed products.

Material Composition: Either of the following, or as required for project:

Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of gypsum or portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.

Sprayed-fiber fire-resistive material consisting of factory-mixed, dry formulation of inorganic binders, mineral fibers, fillers, and additives conveyed in a dry state by pneumatic equipment and mixed with water at spray nozzle to form a damp, as-applied product.

Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:

If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests specified in UL's "Fire Resistance Directory." Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lbf/sq. ft. (7.2 kPa) minimum per ASTM E 736.

Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch (19 mm).

Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

Auxiliary Fire-Resistive Materials

General: Provide auxiliary fire-resistive materials that are compatible with sprayed fire-resistive materials and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

Substrate Primers: For use on each substrate and with each sprayed fire-resistive product, provide primer that complies with one or more of the following requirements:

Adhesive for Bonding Fire-Resistive Material: Product approved by manufacturer of sprayed fire-resistive material.

Sealer for Sprayed-Fiber Fire-Resistive Material: Transparent-drying, water-dispersible protective coating recommended in writing by manufacturer of sprayed-fiber fire-resistive material.

QUALITY CONTROL TESTING

Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

Testing Services: Testing and inspecting of completed applications of sprayed fire-resistive material shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of sprayed fire-resistive material for the next area until test results for previously completed applications of sprayed fire-resistive material show compliance with requirements. Tested values must equal or exceed values indicated and required for approved fire-resistance design.

INSTALLATION GUIDELINES

Examine substrates, areas, and conditions, with Installer present, to determine whether they are in satisfactory condition to receive sprayed fire-resistive material and to verify the following:

Substrates are free of oil, grease, rolling compounds, incompatible primers, loose mill scale, dirt, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.

Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.

Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.

Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.

Where sealers are used, apply products that are tinted to differentiate them from sprayed fire-resistive material over which they are applied.

Apply concealed sprayed fire-resistive material in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if specified in Part 2 "Concealed Sprayed Fire-Resistive Materials" Article.

Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

Repair or replace work that has not been successfully protected.

QUALITY CONTROL

Installer Qualifications: A qualified installer, approved by manufacturer to install manufacturer's products. A manufacturer's willingness to sell its sprayed fire-resistive materials to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

Mockups: Apply mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

WARRANTY

Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace sprayed fire-resistive materials that fail in materials or workmanship within two years from date of Substantial Completion.

Failures include, but are not limited to, cracking, flaking, spalling, eroding in excess of specified requirements; peeling; or delaminating of sprayed fire-resistive materials from substrates.

Not covered under the warranty are failures due to damage by occupants and Owner's maintenance personnel and other causes not reasonably foreseeable under conditions of normal use.

SECTION 07840

FIRESTOPPING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for firestopping of penetrations.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General

Describe in this section all requirements for firestopping wall penetrations, floor penetrations, ceiling penetrations and joints. Do not rely on general references in the Sealants Section for these systems.

This includes boards, blankets, pillows, tapes, caulks, foams, intumescents and other similar materials.

Performance specifications should be used of these systems, and unless noted otherwise should not be limited to a specific manufacturer or vendor.

In those instances where a UL rated systems cannot be attained, it may become necessary to use and Engineering Judgment. Although acceptable to the State, if and only if a published UL listing cannot be met, these shall be used as a last resort for obtaining an approved firestopping assembly.

The General Contractor is solely responsible for coordination, scheduling and the application of the firestop systems for penetrations of all trades. The General Contractor will employee the services of a single applicator to install through-penetration firestop material for all trades and all applications.

Performance Requirements

General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

If Project includes non-fire-resistance-rated constructions requiring that penetrations be protected by through-penetration firestop systems, indicate this on Drawings and insert new subparagraph below noting these exceptions.

SUBMITTALS

Product Data: For each type of product indicated.

Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

Types of penetrating items.

Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.

Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

PRODUCT STANDARDS

Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

INSTALLATION GUIDELINES

Preparation

Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:

Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.

Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.

Remove laitance and form-release agents from concrete.

Through-Penetration Firestop System Installation

Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

The installation of all through-penetration firestop material for all trades will be performed by a single applicator at the direction of the General Contractor.

Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

QUALITY CONTROL

Quality Assurance

Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."

Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

UL in its "Fire Resistance Directory."

Coordination

The General Contractor is solely responsible for coordination, scheduling and the application of the firestop systems for penetrations of all trades.

Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by building inspector, if required by authorities having jurisdiction.

EXAMINATION

Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

Proceed with installation only after unsatisfactory conditions have been corrected.

Cleaning and Adjusting

Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

SECTION 07900

JOINT SEALANTS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for all joint sealants.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General

Describe all requirements for installation of sealants required to prohibit the penetration of moisture and dust, and required to seal joints between dissimilar materials, in this Section.

Specify certain specialized sealants which are ordinarily part of a "complete in place" installation by a particular trade (e.g. glazing sealants and painting) in the appropriate sections.

Pay particular attention in sealant system design to expected joint movement, joint dimensions, sealant position (horizontal, vertical, or overhanging), and potential for physical abuse of the sealed joint.

QUALITY ASSURANCE

Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

SUBMITTALS

Product Data: For each joint-sealant product indicated.

Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

Qualification Data: For Installer.

MATERIALS

Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

- Sealants: 250 g/L.
- Sealant Primers for Nonporous Substrates: 250 g/L.
- Sealant Primers for Porous Substrates: 775 g/L.
- Specify each particular type of sealant and accessory required for a complete system.
- Elastomeric Sealants.
- Latex Joint Sealants
- Acoustical Joint Sealants
- Preformed Joint Sealants
- Preformed Tape Sealants
- Joint Sealant Backing
- Installation Guidelines

Examination

Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

Proceed with installation only after unsatisfactory conditions have been corrected.

Preparation
Contractor is responsible for assuring that all substrates are clean and ready for joint sealants.

Installation of Joint Sealants

General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

Provide a sealant schedule identifying location and type of each sealant.

Cleaning

Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

Protection

Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

WARRANTY

Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

Warranty Period: Two years from date of Substantial Completion.

SECTION 08110

STEEL DOORS AND FRAMES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

Section Includes:
- Pressed steel hollow metal doors and frames.
- Fire-rated hollow metal doors and frames.
- Hollow metal window-walls, glazed openings, and other hollow metal frames for glass.
- Metal louvers in hollow metal doors.
- Rough bucks, frame reinforcing, door reinforcing, door insulation, closer reinforcements, clip angles and anchorage.
- Factory prime paint finish.
- Grouting of hollow metal frames with masonry mortar where not covered under other Sections.

Scheduling
Deliver doors and frames to the jobsite in a timely manner so as not to delay progress of other trades.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

- ANSI A250.8-1998/SDI-100 - Recommended Specifications - Standard Steel Doors and Frames, Steel Door Institute, unless herein specified.
- Underwriters' Laboratories Inc. (UL) UL 10C-98 – Fire Tests of Door Assemblies.
- NFPA-80-1999 – Standard for Fire Doors and Windows.
- NFPA-101-1997 – Life Safety Code.
- NFPA-105 – Standard for Smoke and Draft Control Assemblies.
- ASTM-A 366-95A – Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
- ASTM-A 568-95 – Specification for Steel, Sheet, Carbon, and High Strength, Low-Alloy, Hot-Rolled, and Cold-Rolled.
- ASTM-A 569-91a – Specification for Steel, Carbon, (0.15 maximum percent), Hot-Rolled Sheet and Strip Commercial Quality.
- ASTM-A 924-95 – General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process.
- SDI-105-92 – Recommended Erection Instructions for Steel Frames.
- ANSI A115.1-.18 - Specification for Door and Frame Preparation for Hardware.
- ANSI A156.7 - Standard Template Hinge Dimensions.

SUBMITTALS

Shop Drawings: Submit in accordance with the front end and/or general conditions. Indicate general construction, configurations, jointing methods, reinforcements, and location of hardware and cutouts for glass and louvers.

PRODUCT STANDARDS

Applicable Standards: Specifications and standards of SDI 100-98.

Wind Load Performance Requirements
Comply with wind load requirements of Uniform Building Code. Deflection shall not exceed 1/175 of span.

Supplier Qualification
Qualified direct distributor of products to be furnished. The distributor shall have in their regular employment an A.H.C./C.D.C. or person of equivalent experience who will be available at reasonable times to consult with the Architect, Contractor and/or Owner regarding any matters affecting the total door and frame openings.

Installer Qualification
Experience with installation of similar materials.

Fire-Rated Door Assemblies
Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E152 "Standard Methods of Fire Tests of Door Assemblies" by nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

Oversize Fire-Rated Door Assemblies
For door assemblies required to be fire-rated and exceeding sizes of tested assemblies, provide certificate or label from approved independent testing and inspection agency, indicating that door and frame assembly conforms to requirements of design, materials and construction as established by individual listings for tested assemblies.

Temperature Rise Rating
At stairwell enclosures, provide doors which have Temperature Rise Rating of 450 degrees F maximum in 30 minutes of fire exposure.

Manufacturers
Acceptable Manufacturers: (providing the products supplied comply with the provisions of this specification) Curries, Ceco, Fleming or equal approved by Owner.

MATERIALS

Hollow Metal
Cold Rolled Steel Sheets

- Commercial quality, stretcher leveled flatness, cold-rolled steel, free from scale, pitting or other surface defects, complying with ASTM A366 and A568 general requirements.

Galvanealed Steel Sheets

- ASTM A924, A60 zinc coating. Use galvanealed steel sheets for exterior hollow metal doors, door frames and door louvers. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A569.

Minimum gauges of hollow metal are specified below. Provide heavier gauge if required by details or specific condition. Entire frame and sidelight shall be of same gauge:

- 16 gauge: Interior door frames, and glazed opening frames.
- 16 gauge: Labeled frames (or heavier if required by label).
- 18 gauge: Interior doors (or heavier if required by label).
- 16 Gauge: Exterior door frames, window-wall and window frames, transom and sidelight frames.
- 16 gauge: Exterior doors.
- 20 gauge: Trim members.

Coating Materials, primer

Use manufacturer's standard rust inhibiting primer conforming to ANSI-A224.1-1990.

Related Materials:

- Steel Reinforcing: ASTM A36.
- Door Bumpers or Silencers: Per ANSI A156.16.

Hollow Metal Frames

General

- Form to profiles indicated. Where necessary, alternate details will be considered provided design intent is maintained. Consider and provide for erection methods.

Typical Reinforcing

Provide minimum hinge reinforcement 3/16 inch by 1-1/2 inch by 10 inch. Provide similar reinforcement for hardware items as required to adequately withstand stresses, minimum 12 gauge, including channel reinforcement for door closers and closer arms, door holders and similar items. Provide reinforcement and clearances for concealed in-head door closers and for mortise locks.

Cover Plates

For hinge and strike plate cutouts, provide fully enclosed pressed steel cover boxes spot welded to frames behind mortises.

Hardware

Mortise, reinforce, drill and tap for mortise hardware, except drilling and tapping for surface door closers, door closer brackets and adjusters shall be done in field.

Anchorage

Provide standard and special anchorage items as required. Provide formed steel channel spreader at bottom of frames, removable without damaging frame. At masonry, provide anchors (about 2 inch by 10 inch) approximately 24 inches on center.

Silencers
Provide specified silencers, except where stop does not occur and at smoke gasketed openings, 3 per jamb at single door and one for each door at double doors.

Extensions
Reinforce transom bars or mullions as necessary to provide rigid installation. Where required (as at multiple openings) to stabilize large frames, provide frame or mullion extensions to anchor to structure above, proper size to fit within overhead construction. Provide angle clips to fasten to structure.

Mullions
Provide mullions, straight and without twist, of tubular design. For removable mullions provide reinforcing at frame head.

Clearances
Provide and be responsible for proper clearances at metal frames, including for weatherstripping, soundstripping and smoke gasketing. Glass clearance shall be thickness of glass plus clearance each side (1/8 inch minimum exterior - 1/16 inch minimum interior), adjust for installation, glass thickness to allow for glazing and sealant. Where sealed double glazing is indicated, provide rebates at minimum of 3/4 inch and provide 1/4 inch clearance at glass edges. Where units fit around concrete blocks (blocks built into frames) obtain actual dimensions of blocks being used to establish minimum clearances.

Drip Cap
- Galvanized steel field painted per applicable specifications. Secure to frame at exterior doors.
- Stops
- Set with countersunk or Jackson head screws.

Hospital Stops
On all doors except lead lined doors, doors in 2-hour fire rated partitions and one hour smoke and fire rated partitions; stops shall be cut at 6 inches above floor with 45 degree miter and welded closed.

Labeled Frames
Construct in accordance with requirements for labeled work. Attach proper U.L. label, Warnok Hersey. "B" labeled frames shall be 1-1/2 hour construction.

Joinings
At frames with equal width jambs and head, neatly miter on face (except locations as at transom bars and at frames with large head members). Cope and butt stops. Weld length of entire joint, including face and flat intersections. Grind smooth, at other frames, provide same mitered joint wherever possible (at intersection of jamb-head or jamb-sill) and at other locations butt metal neatly and full weld. If tight butt joints are utilized, joints shall be neatly caulked smooth.

Workmanship
Fabricate so no grind marks, hollow or other out-of-plane areas are visible. At joints of intermediate members (such as mullions and transom bars), provide tight joining, neatly accomplished without holes, burned out spots, weld build up or other defacing work. Fill to close cracks and to preserve shapes. Tightly fit loose stops, to hairline joints.

Finish
Clean frames by degreasing process and apply thorough coating of baked-on primer, covering inside as well as outside surfaces. At galvanealed frames, coat welds and other disrupted surface with zinc-rich paint containing not less than 90 percent zinc dust by weight.

Hollow Metal Frames with electric through wire
Provide all hollow metal frames receiving electrified hardware with ElectroLynx™ or as approved by Owner to seamlessly interface with the electric hardware wiring harness and concealed plug connectors on one end to accommodate up to twelve wires.

Coordinate ElectroLynx™ connectors, or each approved by Owner to seamlessly interface with the electric hardware on end of the wiring harness to plug directly into the electrified hardware and the electric hinge.

Hollow Metal Doors
Provide to design indicated, including flush panel doors, flush panel with cut-out as indicated, stile and rail type, stile and rail with door louver. Use galvanealed steel at exterior doors.

Flush Doors
Reinforce, stiffen and sound deaden. Provide cut-outs for glass and louvers with stops as shown. Provide flush steel closure at top of exterior and interior doors and at bottom of exterior doors with drain holes in bottom closure. Provide seamless edge. Following door construction types are acceptable.

Exterior Doors
Labeled Doors
Insulate as required by Underwriters Laboratories. Build in special hardware and provide astragals as indicated. At one hour and at 1-1/2 hour doors at enclosures, maximum transmitted temperature end point shall not exceed 450 degrees F above ambient at end of 30 minutes of fire exposure per U.L..

Seamless Vertical Edges
Construct doors with smooth flush surfaces, without visible joints or seams on exposed faces or stile edges. Interior and exterior door edge seams shall be full height wire welded and ground smooth.

Exterior Hollow Metal Door Louvers
Fabricate louver units of 16-gauge galvanized steel sheets with stationary, weatherproof Z-shaped blades and U-shaped frames, not less than 1-3/8 inch thick. Space louver blades not more than 1-1/2 inch o.c. Assemble units by welding. Provide insect screen on interior side of frame, consisting of 14 by 18 wire mesh in rigid, formed metal frame.

Interior Hollow Metal Door Louvers
Fabricate of 20-gauge cold-rolled steel sheets with stationary sightproof inverted V-shaped blades and U-shaped frames. Space louver blades not more than 3 inches o.c. Assemble units by welding.

Typical Reinforcement
Provide as required for hardware items. For lock reinforcement, provide manufacturer's standard reinforcement. Provide 12 gauge reinforcement for escutcheons or rose. centering clips to hold lock case in alignment. For door checks, provide 3/16 inch channel type reinforcements, 3-1/2 inch deep by 14 inches long, or as required. Hinge reinforcement minimum 7 gauge by 1-1/2 inch by 9 inch bar. Weld reinforcing to door. Reinforce doors for surface items such as surface and semi-concealed closers, brackets, surface holders and door stops. Drilling and tapping installation of these surface items shall be done in field by hardware installer.

Special Reinforcing
At exterior doors, reinforce inside of door on hinge side with high frequency hinge preparation. Weld to door.

Hardware
Mortise, reinforce, drill and tap for hardware furnished under Section 08710 - Hardware, except drilling and tapping for surface door closers, door closer brackets and adjusters shall be done in field. Obtain templates from hardware supplier.

Finish
Provide prime coat finish on doors. Thoroughly clean off rust, grease and other impurities. Grind welds smooth, no marks shall show. Apply metallic filler as required to fill cracks and joints and to level any weld areas or similar imperfections. Sand filler coat smooth.

Hollow Metal Doors with electric through wire
Provide all hollow metal doors receiving electrified hardware with ElectroLynx™ through-door or as approved by Owner to seamlessly interface with the electric hardware wiring harness and concealed plug connectors on each end to accommodate up to twelve wires.

Coordinate ElectroLynx™ connectors or as approved by Owner to seamlessly interface with the electric hardware on each end of the wiring harness to plug directly into the electrified hardware and the electric hinge.

Hollow Metal Panels
Same materials and constructed and finished in same way as specified for hollow metal doors.

Fastenings
Provide fastenings, anchors and clips as required to secure hollow metal work in place. Provide Jackson head screws, or flatter. Dimple metal work to receive screw heads. Set stops and other non-structural fastenings with #6 Jackson head self-tapping screws.

INSTALLATION GUIDELINES

Examine supporting structure and conditions under which hollow metal is to be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

Deliver hollow metal doors in manufacturer's protective covering. Handle hollow metal with care to prevent damage.

Door Storage
Store doors in upright position, under cover. Place doors on at least 4 inch (101.6) high wood sills or on floors in manner that will prevent rust
and damage. Do not use non-vented plastic or canvas shelters which create humidity chamber and promote rusting. If corrugated wrapper on door becomes wet, or moisture appears, remove wrapping immediately. Provide 1/4 inch (6.3) space between doors to promote air circulation.

Frame Storage
Store frames under cover on 4 inch wood sills on floors in manner that will prevent rust and damage. Do not use non-vented plastic or canvas shelters which create humidity chamber and promote rusting. Store assembled frames in vertical position, 5 units maximum in stack. Provide 1/4 inch space between frames to promote air circulation.
Install hollow metal in accordance with reviewed shop drawings and manufacturer's printed instructions. Securely fasten and anchor work in place without twists, warps, bulges or other unsatisfactory or defacing workmanship. Set hollow metal plumb, level, square to proper elevations, true to line and eye. Set clips and other anchors with Ramset "shot" anchors or drill in anchors as approved. Units and trim shall be fastened tightly together, with neat, uniform and tight joints.

Placing Frames
Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged. In masonry construction, building-in of anchors and grouting of frames with mortar is specified in Section 04810 - Unit Masonry. At in-place concrete or masonry construction, set frames and secure in place using countersunk bolts and expansion shields, with bolt heads neatly filled with metallic putty, ground smooth and primed.
Place fire-rated frames in accordance with NFPA Standard #80.

Door Installation
Fit hollow metal doors accurately in their respective frames, within following clearances: Jambs and head 3/32 inch, meeting edges pair of doors 1/8 inch, sill where no threshold or carpet 1/4 inch above finished floor, sill at threshold 3/4 inch maximum above finished floor, sill at carpet 1/4 inch above carpet. Place fire-rated doors with clearances as specified in NFPA Standard #80.

Cleaning and Adjusting
Prime Coat Touch-Up
Immediately after installation, sand smooth rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

Protection Removal
Immediately before final inspection, remove protective wrappings from doors and frames.

SECTION 08210

WOOD DOORS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

Section Includes:
- Prefinished standard and fire rated type wood doors with flush faces.
- Prefit and premachine pre-finished wood doors.

References
- WDMA: Window and Door Manufacturers Association: IS 1-A 1997 Industry Standard for Architectural Flush Wood Doors.
- NFPA-80 Standards for Fire Doors.
- Uniform Building Code: Latest Edition, Fire Test of Door Assemblies.

Submittals
Shop Drawings and Product Data:
- Indicate general construction, jointing methods, hardware and louver locations, and locations of cut-outs for glass. Indicate thickness of veneers.

Samples
Submit samples of wood veneer and factory finishing in accordance with WDMA Quality Standards I.S. 1-A 1997, sections G-18 and Guide Specifications 1.03 C.

Certification
Submit certification that doors and frames comply with UBC 7-2 1997.

Manufacturers
- Western Oregon Door
- Graham Manufacturing
- Algoma Hardwoods

MATERIALS

Door Construction
- Non-Fire Rated Doors: Thickness: 1-3/4 inches, interior flush wood, bonded, solid core conforming to WDMA I.S. 1-A 1997 and the following:
- Core: bonded particle core (PC) conforming to WDMA I.S. 1-A 1997.
- Door construction shall conform to WDMA I.S. 1-A 1997 Premium Grade requirements.
- Stiles: Hardwood to match face veneer over structural composite lumber (SCL), glued to core.
- Rails: Mill option hardwood or SCL. Top and bottom: 2 inches.
- Facing: Wood veneer as specified.

Fire Rated Doors: Thickness: 1-3/4 inches, interior flush wood, bonded, solid core conforming to WDMA I.S. 1-A 1997 and the following:

- Core: bonded mineral core (FD) conforming to WDMA I.S. 1-A 1997.
- Door construction shall conform to WDMA I.S. 1-A 1997 Premium Grade requirements.
- Stiles: Hardwood to match face veneer over mineral composite, glued to core.
- Rails: Mineral composite as required by fire door authorities. Top and bottom: as required by manufacturer's fire door authorities.
- Facing: Wood veneer as specified.

Wood Veneer
Door face veneers shall meet HPVA "A" grade quality standards conforming to WDMA I.S. 1-A for transparent or semi-transparent finish. Minimum face veneer thickness shall be 1/50" at 12% moisture content after finish sanding.

- Species: Red Oak.
- Face Cut: Plain Sliced.
- Face Assembly: Book Match.
- Face Symmetry: Center Balanced Match.

Adhesives
Face to core adhesives shall be Type I as appropriate for location in building. Adhesives must be classified Type I per WDMA TM-6 "Adhesive Bond Test Method", or PUR adhesive. Type I adhesives shall be used for doors in exterior applications.

Core

- Non-rated and 20 minute doors: Solid particleboard.
- Fire-rated doors: Non-combustible mineral core containing no asbestos.

Factory Finishing

- Comply with referenced WDMA Section G-15, "Factory Finishing".
- Pre-finish wood doors at factory with standard clear finish.
- Transparent Finish: Match finish indicated in WDMA Section G-17: WDMA System #6.

Accessories or Special Features
Vision Frames

- Non-rated doors: Flush wood frames, hardwood to match facing.
- Fire-rated doors: ITS: Warnock Hersey or UL approved glazing system.
- Glass: Refer to Section 08810 for glass types.

INSTALLATION GUIDELINES

Product Handling
Plastic wrap and protect wood doors during transit, storage and handling to prevent damage, soiling or deterioration. Follow the Care and Installation guidelines as described in WDMA I.S. 1-A 1997.

Fabrication
Fabricate wood doors in accordance with requirements of WDMA I.S. 1-A 1997 Quality

Standards.
Fabricate fire rated doors in accordance with requirements of ITS: Warnock Hersey or Underwriters' Laboratories, with metal label on each door including UL-10C.

Fabricate doors with WDMA Quality Standards hardware blocking options as follows:

- Provide HB-1: head and HB-2: sill rails and HB-4: lock block on all doors.
- Provide HB-6 only when exit devices are specified for door.
- Provide HB-8 for pivots or when floor bolts are specified under Section 08710 – Finish

Hardware.
Provide doors with minimum 1/4 inch thick edge strips, of wood species to match face veneers except as required for fire rating.

Make cut-outs and provide stops for glass and louvers. Install metal door louvers. Seal cut-outs prior to installation of moldings.

For full light doors: Provide cut out from flush wood door, with vertical grain direction.

Bevel lock edge only of single acting doors 3 degrees or 1/8 inch in 2 inches. Radius strike edge of double acting swing doors as required by pivot hinge manufacturer.

Prepare doors to receive hardware. Refer to Section 08710 - Hardware and NFPA 80 for hardware requirements including UL-10C.

Prefit and bevel to net opening size less approximately 1/4 inch in width on single swing doors 3/16 inch in width for paired doors. Provide 1/4 inch clearance above finished floor, unless otherwise indicated on drawings. Provide 1/8 inch clearance at top of door.
Slightly ease vertical edges.

Fire Rated Pair of Doors; greater than 20 minute: Supply overlapping astragals or metal edge sets only as required by NFPA 80 1999 or by door manufacturer’s fire door authorities. If an astragal is required, to comply with fire rated labeling requirements for pairs of fire rated doors, provide door manufacturer's standard tested astragal.

Examination
Examine installed door frames before hanging doors.

Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.

Proceed with installation only after unsatisfactory conditions have been corrected.

INSTALLATION

Handle doors in accordance with recommendations of WDMA I.S. 1-A, “Care and Installation at Job Site.”

Condition doors to average temperature and humidity in area of installation for not less than 48 hours prior to installation. Store doors per recommendations of WDMA I.S. 1-A, “Care and Installation at Job Site.”

Install in neat and workmanlike manner, free from hammer or tool marks, open joints or slivers.

Set plumb, level, square and true. Install work after building humidity is at acceptable level.

Remove and replace all doors found to be warped, twisted, bowed, or otherwise damaged. Do not install doors which cannot be properly fitted to frames.

Adjust pre-finished doors and hardware and other moving or operating parts to function smoothly and correctly.

If doors are to be field finished, the process must follow the WDMA I.S. 1-A, “Care and Handling at Job Site” instructions for field applied finishes.

QUALITY CONTROL

Quality Assurance
Fire-Rated Wood Doors: Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies in accordance NFPA 252 and which are labeled and listed for ratings indicated by ITS – Warnock Hersey, UL or other testing and inspection agency acceptable to authorities having jurisdiction.

Doors: Comply with UBC 7-2 1997 where required.

Provide intumescent requirements in compliance with UL-10C.

WDMA I.S. 1-A 1997 Quality Standard: Window and Door Manufacturers Association Quality Standards for grade of door, core, construction, finish, and other requirements.

Temperature Rise Rating: At stairwell enclosures, provide doors which have Temperature Rise Rating of 250 degrees F maximum in 30 minutes of fire exposure.

Cleaning and Adjusting
Clean prefinished doors and hardware.

At clear finished doors, do not partially cover door surfaces with paper, cardboard, or any other opaque covering that will create uneven aging of wood veneer.

Protect doors as directed under Section 01700.

Refinish or replace finished doors damaged during installation.

Warranty
Provide manufacturer’s guarantee for all wood doors. Guarantee period: Lifetime of original installation. Doors exhibiting defects in materials or workmanship including warp and delamination within guarantee period shall be replaced (including hanging and finishing) with new doors. These terms shall be part of the manufacturer’s standard warranty.

SECTION 08300

ACCESS DOORS AND FRAMES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for special doors and openings.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Provide access doors to overhead areas, mechanical equipment rooms, elevator equipment spaces, and ceiling and wall spaces where equipment, and/or valves require access.

Coordinate with work in other divisions (i.e., electrical and mechanical). On architectural drawings show all access doors on ceiling plans and/ or wall elevations. Do not rely on contractors to locate and identify the requirement for access doors from mechanical and electrical drawings.

SUBMITTALS

Product Data: For each type of door and frame indicated. Include construction details relative to materials, individual components and profiles, finishes, and fire ratings (if required) for access doors and frames.

Shop Drawings: Show fabrication and installation details of customized doors and frames. Include plans, elevations, sections, details, and attachments to other Work.

Schedule: Provide complete door and frame schedule, including types, general locations, sizes, construction details, latching or locking provisions, and other data pertinent to installation.

Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items with concealed framing, suspension systems, piping, ductwork, and other construction. Show the following:

Method of attaching door frames to surrounding construction.

PRODUCT STANDARDS

Products

- Minimum size shall be 16” x 16” for walls and 24” x 24” for ceilings. Size may vary if required for replacement of materials and/or equipment.
- Access doors shall be fire rated where required, and all locations shall be noted on plans.
- All access doors shall be metal.

Paint
Shop Primers: Provide primers that comply with Division 9 Section "Painting."

Access Doors and Frames
- Flush, Insulated, Fire-Rated Access Doors and Trimless Frames: Fabricated from steel sheet.
- Fire-Resistance Rating: As required to maintain partition fire rating.
- Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch.
- Frame: Minimum 0.060-inch-thick sheet metal with drywall bead.
- Hinges: Concealed pin type.
- Automatic Closer: Spring type.
- Lock: Key-operated cylinder lock with interior release.

INSTALLATION GUIDELINES

Fabrication
General: Provide access door assemblies manufactured as integral units ready for installation.

Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

For trimless frames with drywall bead for installation in gypsum board assembly, provide edge trim for gypsum board securely attached to perimeter of frames.

Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

Other devices available include pull rings, Allen head, Phillips head, spanner head, tee handle, push button, and thumb turn.

For cylinder lock, furnish two keys per lock and key all locks alike.

Finishes, General
Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

Finish metal fabrications after assembly.

Preparation
Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

Installation
Comply with manufacturer's written instructions for installing access doors and frames.

QUALITY CONTROL

Source Limitations: Obtain doors and frames through one source from a single manufacturer.

Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are labeled and listed by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction:

NFPA 252 or UL 10B for vertical access doors.

Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified in "Submittals" Article.

SECTION 08331

OVERHEAD COILING DOORS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for overhead coiling doors.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Provide overhead coiling doors where required for service or large access. Avoid the use of swing type pair doors for access.

Where egress is required, provide adjacent (not integral) personnel exit door assembly.

If required to be insulated use a sectional garage type door.

SUBMITTALS

Shop Drawing: Furnish shop drawings for architect's approval. Include elevations, sections, and details indicating dimensions, materials, finishes, conditions for anchorage and support of each door.

Product Literature: Submit manufacturer's technical literature describing the product to be used under this section including UL ratings.

Maintenance and Operating Manuals: Furnish complete manuals describing the materials, devices and procedures to be followed in operating and maintaining all doors under this section. Include manufacturer's brochures and parts lists describing the actual materials used in the product.

Warranty: Furnish written warranty signed by the manufacturer and installer.

PRODUCT STANDARDS

Assembled of galvanized steel slats, cold rolled. Slats shall have endlocks locking each end of alternate slats to act as a wearing surface, and maintain slat alignment. Curtain shall be 20 gauge minimum or gauge required by Underwriters Laboratories whichever is greater.

Slats: Shall be equal to McKeon F3 slat design with a cross section not less than 3" wide by 7/8" deep. Slat galvanizing shall be of a hot process with a high grade zinc coating (minimum 1.25 oz. per square foot).

Bottom bar: Shall be of a double angle assembly equipped with an obstruction sensing safety edge.

Vision Panel (If required): Provide 3 hour UL approved vision lights 1 ½" in height by 5" in length in quantities and slat configuration as indicated on contract drawings.

Smoke Seals: Provide UL approved perimeter smoke seals conforming to UL1784. Provide units with an "S" Label.

Grooves:
Each fire door is to be mounted on 3" x 3" structural steel tubes provided by the door manufacturer. Tubes shall be constructed with a slip joint at the top to provide for thermal expansion.

Each assembly shall be fabricated of a minimum 3" x 3" self supporting steel tubes, with 1/8" thick minimum steel shapes with a minimum 3-1/2" depth. Grooves shall be provided with slotted holes to allow for thermal expansion.

Floating Guide: The bottom of each curtain shall be equipped with a double angle floating guide to ensure proper feeding of the curtain into the door frame.

Hoods: Shall be provided to entirely enclose coiled curtain and counterbalance assemblies. Hoods shall be of a half hexagon design to match brackets. Tops and bottoms shall be bent and reinforced for stiffness. Provide intermediate support brackets at all seams to prevent sagging.

Electric Motor Operator: Electrically operated doors shall be provided with a compact power unit designed and built by the door manufacturer. Operators shall be equipped with an adjustable screw-type limit switch to break the circuit at termination of travel. High efficiency planetary gearing running in an oil bath, shall be furnished together with a centrifugal governor, spring-set solenoid-operated brake and a fail-safe magnetic release device, completely housed to protect against damage, dust, and moisture. Operator is to be NEMA type 1 enclosure. An efficient overload protection device, which will break the power circuit and protect against damage to the motor windings shall be integral with the unit.

Motor: Shall be totally enclosed fan cooled, continuous duty, thermally protected, ball bearing type with a class A or better insulation. Single phase motors shall be capacitor start, polyphase shall be squirrel cage induction. Horsepower of motor is to be 1/2 HP minimum or of manufacturer's recommended size, which ever is greater.

Starter: Shall be size "00" magnetic reversing starter, across the line type with mechanical and electrical interlocks, with 10 amp continuous rating and 24 volt control circuit.
Reducer: Planetary gear type, 90% efficiency minimum, 77:1 reduction.

Control Station: All operators are to be furnished with flush mount key switch control station.

Self-Closing Mechanism: The fire door is to be designed with a centrifugal governor as an integral part of the operator's construction. The automatic release mechanism shall be triggered by a fusible link, smoke detector or fire alarm. When triggered the door is released and begins to close due to gravitational force. The speed of the door is governed by a centrifugal governor, designed to match the normal operating speed of the door, at a rate of not greater than 9" per second or less than 6" per second.

Magnetic Release Mechanism: A fail-safe magnetic release device shall be built into the operator as an integral part of the release mechanism. When power is interrupted to the release mechanism by the smoke detector or fire alarm, the door shall begin to self-close. In the event of a complete power failure, the magnetic release mechanism shall release causing the door to self-close. Once the power is restored, the fire door shall resume normal function without any resetting or adjustment to the limit switches.

Easy Drop Test Feature: The fire door shall be designed so that it may be drop-tested simply by cutting power to the operator. By turning the power switch off, the door shall self-close. Once the fire door has satisfactorily closed, it shall be reset simply by turning the power back on. No ladders or tools shall be needed to reset the door.

Painting: After completion of fabrication, clean all metal surfaces to remove dirt and chemically treat to provide for paint adhesion. Apply baked on enamel primer. Slats are to receive a prime coat of .2 mils of Epoxy primer and .8 mils of Polyester paint.

INSTALLATION GUIDELINES

Perform installation using only factory approved and certified representatives of the door manufacturer.

Adjust door installation to provide uniform clearances and smooth non-binding operation.

Install wiring in accordance with applicable local codes and the National Electrical Code. Standard Materials shall be UL listed.

Test door closing sequence when activated by the building's fire alarm system. Reset door after successful test.

QUALITY CONTROL

Quality Assurance

Fire-Rated Assemblies: Provide all doors with fire resistance rating required to comply with governing regulations which are inspected, tested, listed and labeled by UL, complying with NFPA 80 for class of opening. Provide UL label permanently fastened to each fire door assembly.

Regulatory Requirements: Door will be provided with an “S” Label and tested in accordance with UL10B and UL1784.Comply with applicable requirements of the laws, codes, ordinances and regulations of federal, state and municipal authorities having jurisdiction.

Examination
Examine surfaces and field conditions to which this work is to be performed and notify architect if conditions of surfaces exist which are detrimental to proper installation and timely completion

of work.

Verify all dimensions taken at job site affecting the work. Notify the architect in any instance where dimensions vary.

SECTION 08411

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for aluminum framed entrances, storefronts and aluminum windows.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General
- System shall be “engineered.”
- Consultant shall evaluate how future reglazing is easily accomplished, and preferably from the exterior to minimize occupant disruption.
- Aluminum storefront systems shall accommodate UNLV’s hardware requirements.

Performance Requirements
General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:
- Structural loads.
- Thermal movements.
- Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
- Specify dimensional tolerances for support system and adjacent construction in other Sections of this Project's Specifications.
- Deflection requirements
- Water and wind penetrations

Quality Assurance
Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.

Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies like those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

Project Conditions
Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

SUBMITTALS

Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

Glazing.

PRODUCT STANDARDS

Products
Use products with high percentage of recycled and post-consumer content.

Framing Systems/Components

Doors
- Doors: Manufacturer's standard glazed doors, for manual swing operation.
- Door Construction: 2-inch overall thickness, with minimum 0.188-inch-thick, extruded-aluminum tubular rail and stile members. Rail and stile voids shall be packed with mineral wool to achieve a STC 33 rating. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods. Wide style type.
- Coordinate door design with hardware requirements. Narrow stile doors may not be able to accommodate some exit devices.
- Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
- Door Hardware: As specified in Division 8 Section "Door Hardware."

Windows
- Manufacturer's standard glazed windows. Custom sizes shall be reviewed with manufacturer.
- Window Construction: 2-inch overall thickness, with minimum 0.188-inch-thick, extruded-aluminum tubular rail and stile members.

- Operable Windows: Per manufacturer’s standard details.

- System shall provide positive drainage to the exterior.

Aluminum Finishes
- General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- All finishes shall be noted. Anodized or powder coated shall have class of finish.
- If Kynar finish is specified, provide for a 20-year finish warranty.

Framing Systems/Components
Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

Construction: Framing members are composite assemblies of two separate extruded-aluminum components permanently bonded by an elastomeric material of low thermal conductance.

Determine if window washing hooks or roof mounted systems are required.

If sunscreens, light-shelfs or other aluminum system components are incorporated in the design, all components and aluminum systems shall be from the same manufacturer and shall have been tested assemblies. UNLV prefers not t be a test site for un-tested assemblies or construction.

System shall provide positive drainage to the exterior.

Manufacturers
Available Manufacturers: The design should be based on Kawneer or equal as the Basis of Design. Subject to compliance with the requirements and compatibility of the architectural design, details and attachment, manufacturers offering products may be incorporated into the Work.

System shall be selected and designed for specific installation requirement.

INSTALLATION GUIDELINES

Comply with manufacturer's written instructions.

Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.

Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

Entrances: Install to produce smooth operation and tight fit at contact points.

QUALITY CONTROL

Examination
Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

Cleaning and Adjusting
Entrances: Adjust operating hardware for smooth operation per hardware manufacturers' written instructions.

For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch measured to the leading door edge.

WARRANTY

Warranty Period: Five years from date of Substantial Completion

Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

SECTION 08500

METAL WINDOWS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for metal framed windows.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General
Includes cold-formed welded steel windows.

Quality Assurance
Installer Qualifications: An installer acceptable to steel window manufacturer for installation of units required for this Project.

SWI Publication: Comply with applicable requirements in SWI's "The Specifier's Guide to Steel Windows" except where more stringent requirements are indicated.

Fire-Test-Response Characteristics: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to the test method indicated.

Project Conditions
Field Measurements: Verify steel window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

SUBMITTALS

Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for steel windows.

Shop Drawings: Include plans, elevations, sections, details, attachments to other work, and the following:

Layout and installation details, including anchors.

Elevations of continuous work at 1/4 inch = 1 foot scale and typical window unit elevations at 3/4 inch = 1 foot scale.

PRODUCT STANDARDS

Use products with high percentage of recycled and post-consumer content.

Cold-Formed Steel Window Members: Provide frame members mechanically formed from metallic-coated, low-carbon, cold-rolled steel sheet complying with ASTM A 653.

Glazing beads shall be manufacturer's standard.

INSTALLATION GUIDELINES

Fabrication

- General: Fabricate steel windows of type and in sizes indicated to comply with SWI standards. Include a complete system for assembly of components and anchorage of window units.
- Provide units that are reglazable.

INSTALLATION

Comply with manufacturer's written instructions for installing windows, hardware, operators, accessories, and other components.

Install windows level, plumb, and true to line, without distortion. Anchor securely to surrounding construction with approved fasteners.

Separate corrodible surfaces subject to electrolytic action at points of contact with other materials.

Set sill members in a bed of sealant or with gaskets, as indicated, for weathertight construction.

Seal exterior joints between window frame and opening substrate with sealant.

Repair abraded areas of factory-applied finishes.

QUALITY CONTROL

Examination

Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances, rough opening dimensions, levelness of sill plate, coordination with wall flashings and vapor retarders, and other conditions affecting performance of work.

Proceed with installation only after unsatisfactory conditions have been corrected.

SECTION 08710

FINISH HARDWARE

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

Section Includes:

- Finish hardware for doors as specified and as listed in “Hardware Groups: and required by actual conditions.
- Include screws, special screws, bolts, special bolts, expansion shields and other devices for proper application of hardware.

Hardware Groups

Contact UNLV AHC Representative for hardware sets.

Coordinate with UNLV Lock Shop for latest representative contact information.

NOTICE TO ARCHITECTS/ SPECIFICATION CONSULTANTS

- No Full Glass (Herculite) style doors are to be used.
- No surface or concealed vertical rod exit devices. Provide rim exit devices with key-removable mullions.
- No magnetic locks are to be used.

Electric Strikes and door position switches are to be specified in hardware sets and will be furnished by the access control supplier.

Lock power supplies and the access control system will be furnished by the access control supplier.

System Design and Performance Requirements
Provide items, articles, material, operations and methods listed, mentioned or scheduled herein or on drawings, in quantities as required to complete project. Provide hardware that functions properly.
Prior to furnishing hardware, advise Architect of items that will not operate properly, are improper for conditions, or will not remain permanently anchored.

SUBMITTALS

Hardware Schedule: Submit 6 copies of hardware schedule in vertical format as illustrated by the Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute prior to fabrication or delivery of product to the jobsite. Schedules which do not comply will be returned for correction before checking.

Hardware schedule shall clearly indicate architect’s hardware group and manufacturer of each item proposed.

The schedule shall be reviewed prior to submission by an experienced door and hardware professional who can attest to the completeness and correctness of the document:

Provide PDF copy of illustrations from manufacturer's catalogs and data in brochure form.

Check specified hardware for suitability and adaptability to details and surrounding conditions. Indicate unsuitable or incompatible items and proposed substitutions in hardware schedule.

Provide listing of manufacturer's template numbers for each item of hardware in hardware schedule.

Furnish other Contractors and Subcontractors concerned with copies of final approved hardware schedule. Submit necessary templates and schedules as soon as possible to hollow metal, wood door and aluminum door fabricators in accordance with schedule they require for fabrication.

Samples: Submit samples of each type of exposed hardware unit in the correct finish specified and tagged with full description for all items that were not listed or specified in this specification. Provide 3 samples prior to submission of final hardware schedule. Samples will be returned to supplier. Samples that are acceptable and remain undamaged through the submittal review process, and any required field comparison process may, after final check of operation, be incorporated in work, within limitations of keying and coordination requirements.

Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying has been fulfilled.

Wiring Diagrams: Provide complete and detailed system operation and elevation diagrams specially developed for each opening requiring electrified hardware, except openings where only magnetic hold-opens or door position switches are specified. Provide these diagrams with hardware schedule submittal for review. Provide detailed wiring diagrams with hardware delivery to jobsite.

Installation Instructions: Provide manufacturer's written installation and adjustment instructions for finish hardware. Send installation instructions to site with hardware.

Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.

Operating and maintenance manuals: Submit PDF set containing the following:

- Complete information in care, maintenance and adjustment, and data on repair and replacement parts and information on preservation of finishes.
- Catalog pages for each product.
- Name, address and phone number of local representative for each manufacturer.
- Parts list for each product.
- Copy of final approved hardware schedule, edited to reflect "As Installed".
- Copy of final keying schedule.

- As installed "Wiring Diagrams" for each opening connected to power, both low voltage and 110 volts.

One complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

One dogging key for each exit device.

Manufacturers
Hinges
Acceptable Manufacturers and Types:

Bommer	McKinney
BB5014	T4A3786
BB5000	TA2714
BB5001	TA2314
BB5005	T4A3386

Non-removable pins (NRP)

Provide NRP (non-removable pins) at outswing lockable doors.
Size

2-1/4" thick doors	5" X 5"
1-3/4" thick doors	4-1/2" X 4-1/2"
1-3/8" thick doors	3-1/2" X 3-1/2"

Quantity
2 hinges per leaf for openings through 60 inches high.
1 additional hinge per leaf for each additional 30 inches in height or fraction thereof.
4 hinges for Dutch doors up to 90 inches in height.

Drill 5/32 inch hole and use No. 12, 1-1/4 inch steel, threaded to the head, wood screws for hinges on wood doors.;

Electric Hinges
Acceptable manufacturers:

Command Access (No substitutions)
ETH x No. Wires Required x 4545

Provide sufficient number of concealed wires to accommodate electric function of specified hardware.

Locate electric hinges at second hinge from bottom of door. Where electric hinges are used in conjunction with exit devices, locate hinge nearest to exit device.

Provide mortar guide like McKinney MG-16 for each electric hinge specified.

Continuous Geared Hinges
Acceptable manufacturers:

Pemko	McKinney
CFM__HD1	MCK-25HD
CFS__HD1	MCK-22HD
CHS__HD1	MCK-54HD
KCFM__HD1	MCK-K25HD

Provide one of the above two models of continuous hinges as appropriate for the type, inset and thickness of door where specified. Coordinate hinge types with the door supplier.

Locksets-Bored
Acceptable manufacturers and Series:

Yale	Schlage
B-AU5400LN	ND90BD Series x Rhodes x Less Core

Provide lock functions specified in Hardware Groups, with the following provisions:

Locks shall meet the requirements of ANSI/BHMA A156.2-2003, operational Grade 1. Provide SFIC cylinder cores as specified in hardware groups.
Backset: 2-3/4”

Strikes: Provide wrought boxes and strikes with proper lip length to protect trim but not to project more than 1/8” beyond trim, frame or inactive leaf. Where required, provide open back strike and protect with astragal to allow practical and secure operation.

All locks and latches must be BHMA certified.

Locksets-Mortise
Acceptable manufacturers and Series:

Yale	Schlage
AUR8800FL x Less Cylinder	L9000 x 06B x Less Cylinder

Provide lock functions specified in Hardware Groups, with the following provisions:

Locks shall meet the requirements of ANSI/BHMA A156.13-2005, operational Grade 1 and Security Grade 1. Provide SFIC cylinder cores as specified in hardware groups.

Backset: 2-3/4”

Strikes: Provide wrought boxes and strikes with proper lip length to protect trim but not to project more than 1/8” beyond trim, frame or inactive leaf. Where required, provide open back strike and protect with astragal to allow practical and secure operation.

All locks and latches must be BHMA certified.

Exit Devices and Key-Removable Mullions
Acceptable manufacturers and Series:

Yale	Von Duprin
7000 Series x AU600F	99 Series x 996L-NL x 06
KRM200	KR4954

Provide exit device series and functions as specified in Hardware Groups.

All exit devices shall be UL listed for panic. Exit devices for labeled doors shall be listed as "Fire Exit Hardware".

Where lever trim is specified, provide lever design to match lock levers.

Provide cylinders for key locking mullions and exit devices with locking trim.

Provide keyed removable mullions as specified in the Hardware Groups.

All exit devices must be BHMA certified.

Electric Strikes
Acceptable manufacturers and Series:

HES (No substitutions)
1006 Series
7000 Series
9500 Series
9600 Series

Provide electric strikes designed for use with the type locks shown at each opening where specified.

Electric strikes shall be UL Listed as burglary resistant electric door strikes and, where required, shall be UL Listed as electric strikes for fire rated doors and frames. Provide fail secure type electric strikes unless otherwise specified.

Provide power supplies for each electric strike as required. Verify voltage with electrical contractor.

Keying
Acceptable manufacturers and Series:

Yale (No substitutions)
KeyMark

Master key or Grand master key cylinders and key in groups, unless otherwise specified. Factory masterkey with manufacturer retaining permanent keying records.

Provide 6 masterkeys for each masterkey set. Provide 3 change keys for each lock. Provide 2 control keys for core removal. Stamp keys: "DUPLICATION PROHIBITED BY FEDERAL UTILITY PATENT LAW". Do not stamp keys with bitting ID or keying ID. All keys MUST be ordered with the “VKC0” option.

Hardware supplier shall meet with the UNLV Lock Shop to determine keying requirements of the project. Submit proposed keying schedule in a standard DHI format to the UNLV Lock Shop for final approval. Provide approved keying schedule in a standard DHI format to Vegas Valley Locking Systems to accompany keys, cores, and housings order.

Provide construction cores for use during the construction phase of the project. Hardware supplier is responsible for supplying the correct cylinder collars and spacers as required. Upon substantial completion, coordinate replacement of construction cores with permanent cores. Return construction cores to the supplier.

All permanent cores, housings, and keys are to be Yale KeyMark only. No substitutions will be allowed. Contact Vegas Valley Locking Systems (702-614-3939) for pricing prior to bidding this section. Exclusions of the KeyMark keys, cores and housings will NOT be allowed or acceptable.

Permanent cores and cylinders are to be installed by Vegas Valley Locking Systems. All permanent keys are to be delivered directly to the UNLV Lock Shop by Vegas Valley Locking Systems. No exceptions allowed.
Authorized Yale KeyMark dealer: Vegas Valley Locking Systems (702) 614-3939.

Door Trim
Acceptable manufacturers and Series:

McKinney	Don-Jo	Trimco
PO53	71	1001-3
DP503	7115	1010-3
OP8102	1157147	1737
KP50	90	KO050

Pulls: Where required, mount back to back with push bars.

Kick and Armor Plates: Minimum of .050” thick, beveled 4 edges.

At single and pairs of doors provide kick and armor plates 2” less door width (2” LDW).

Provide kick plates at a height of 10” unless otherwise specified.

Door Closers
Acceptable manufacturers and Series:

Norton	LCN
7500/PR7500	4041/4041EDA
UNI-7500	4041CUSH

Provide non-sized closers, adjustable to meet maximum opening force requirements of ADA.

Provide drop plates, brackets or adaptors for arms and as required to suit details.

Install closers on room side of corridor doors, inside of exterior doors and stair side of stairway doors.

Provide back check for all door closers.

Provide hold open arms where specified.

Provide closers as specified in Hardware Groups and, in addition, provide closers for labeled doors whether or not specifically noted in Hardware Groups.

Provide closers meeting the requirements of UBC7-2, 1997 and UL 10C positive pressure tests.

Closers/Holders
Acceptable manufacturers and Series:

Norton	LCN
7700PT	4040SE
7210MPI	4310ME

Provide non-sized closers, adjustable to meet maximum opening force requirements of ADA.

Provide drop plates, brackets or adaptors for arms and as required to suit details.

Install closers on room side of corridor doors, inside of exterior doors and stair side of stairway doors.

Provide back check for all door closers.

Provide single point or multi-point hold open where specified.

Provide closers meeting the requirements of UBC7-2, 1997 and UL 10C positive pressure tests.

Automatic Operators
Acceptable manufacturers and Series:

Stanley (No substitutions)	Curran Engineering
Magic-Force Operators	Actuators

Provide automatic operators as specified in Hardware Groups. Provide complete with drop plates, brackets or adaptors for arms as required to suit details.

Provide wall mounted actuator switches. Actuators shall be weather resistant type at exterior doors.

Contact Vegas Valley Locking Systems or an approved alternate source for Stanley Automatic Operators and actuators.

Overhead Stops
Acceptable manufacturers and Series:

Rixson (No substitutions)
10 Series
9 Series

Provide overhead stops for doors that open against equipment, casework, sidelites, or other objects that would make wall stops inappropriate.

Provide plated finishes only. Sprayed finishes are not acceptable.

Provide sex bolts to attaché overhead stops and holders to mineral core doors.

Wall Stops and Holders
Acceptable manufacturers and Series:

McKinney	Don-Jo	Trimco
WS01	1406	1270WX
WS02	1407	1270WV
FS01	1440	1211
FS29	1448	1214
FS30	1449	1214H

Provide wall stops as applicable for each door leaf, except where floor stops are specified in Hardware Groups, or where conditions require the use of an overhead stop.

Provide an appropriate carpet rise for floor stops, as needed.

Thresholds
Acceptable manufacturers and Series:

McKinney	Pemko
MCK272_	272_

Provide thresholds to match details.

Refer to drawings for details. Provide accessories, shims and fasteners, as required.

Where thresholds occur at openings with one or more mullions, they shall be cut for the mullions and extended continuously for the entire opening.

Install thresholds using an ‘H’ cut with the threshold contacting the inside and outside rabbets, stops and soffit.

Weather-stripping
Acceptable manufacturers and Series:

Product	McKinney	Pemko
Sweeps	MCK18100CNB	18100CNB
Meeting Stile	MCK18041CNB	18041CNB
Jambs	MCK45041CNB	45041CNB
Raindrip	MCK346C	346C

Provide self tapping fasteners for weather-stripping being applied to hollow metal frames.

Provide specified brush weather-strip seals in black color.
Where rain drips are specified in hardware groups, provide raindrip X fill frame width, unless detailed otherwise.

Gasketing
Acceptable manufacturers and Series:

McKinney	Pemko
MCKS88D	S88D
MCKHSS2000	HSS-2000

Provide gaskets for 20 Minute doors and doors designated for smoke and draft control.

Where frame applied intumescent seals are required by the manufacturer, provide gaskets that comply with UC 7-2 and UL 10C positive pressure tests.

Install adhesive mounted smoke seals per manufacturer’s direction and provide silencers as needed to prevent door to frame contact.

Sound Gasketing
Acceptable manufacturers and Series:

McKinney	Pemko
MCK434ARL	434ARL
MCK4301CRL	4301CRL
MCKS88BK (Double Row)	S88BK (Double Row)

Magnetic Holders
Acceptable manufacturers and Series:

Rixson (No substitutions)
998

Verify voltage with Electrical Contractor.

Provide transformer for each wall magnet (low voltage).

Latch Protectors
Acceptable manufacturers and Series:

	Don-Jo
Mortise	PMLP-111
Bored	PLP-111
Bored	ILP-206
Alum	LP-307/OLP2650/51

Latch protectors shall be stainless steel of the type required to work with the specified lock.

Fasteners
Use only manufacturer supplied fasteners to anchor, attach or otherwise install all pieces of hardware.

Install all door closers and exit devices with machine screws, whether or not self-tapping (self drilling) fasteners are offered by the manufacturer. Provide sex bolts (SNB) at fire rated wood doors unless approved proper blocking is provided by the door manufacturer.

Use phillips head at all exposed screws. Aluminum screws are not acceptable to attach or install any hardware.

Provide self-tapping (self-drilling) screws for attachment of sweeps and stop applied weatherstrip only.

Replace all fasteners that have damaged heads due to inappropriate installation methods.

MATERIALS

Finishes and Materials
Hinges
- Exterior: BHMA 630 (US32D)
- Interior: BHMA 652 (US26D)

Continuous Hinges
- BHMA 628 (US28)

Flush Bolts
- BHMA 626 (US26D)

Exit Devices
- BHMA 630 (US32D)

Locks and Latches
- BHMA 626 (US26D)

Pulls, Push Plates, Push Bars
- BHMA 630 (US32D)

Coordinators
- BHMA 600 (USP)

Kick Plates, Armor Plates and Edge Guards
- BHMA 630 (US32D)

Overhead Stops and Holders
- Exterior: BHMA 630 (US32D)
- Interior: BHMA 652 (US26D)

Surface Mounted Door Closers
- BHMA 689 (Painted Aluminum)

Latch Protectors
- BHMA 630 (US32D)

Miscellaneous Hardware
- BHMA 626 (US26D)

Knox Boxes
- Model 3200-R, 4”W X 5” H X 3-1/4”D with 7”W X 7”H flange, black polyester powder coat finish.

Electrical Subsitutions
The electrical products and designs contained within this specification represent a carefully engineered system. Alternate electrical products or designs are the responsibility of the distributor to bear the cost of providing a complete and working system, including re-engineering of electrical diagrams, wiring diagrams and system layout, as well as power supplies, power transfers and all required electrical components. Coordinate with security systems contractor and electrical engineer to ensure that line voltage and low voltage wiring is coordinated to provide a complete and properly working system.

INSTALLATION GUIDELINES

Delivery Storage and Handling

Deliver hardware to jobsite in manufacturer’s original packaging, marked to correspond with approved hardware schedule. Do not deliver hardware until suitable locked storage space is available. Check hardware against reviewed hardware schedule. Store hardware to protect against loss, theft or damage.

Deliver hardware required to be installed during fabrication of hollow metal, aluminum, wood or stainless steel doors prepaid to manufacturer.

Examination
Examine doors, frames and related items for conditions that would prevent the proper application of finish hardware. Do no proceed until defects are corrected.

INSTALLATION

Install finish hardware in accordance with reviewed hardware schedule and manufacturer’s printed instructions. Prefit hardware before finish is applied: remove and reinstall after finish is completed. Install hardware so that parts operate smoothly, close tightly and do not rattle.

Installation of hardware shall comply with NFPA 80 and NFPA 101.

Set units level, plumb and true to line and location. Adjust and reinforce attachment to substrate as necessary for proper installation and operation.

Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

Set thresholds for exterior doors in full bed of butyl rubber or polyisobutylene mastic sealant, forming tight seal between threshold and surface to which set. Securely and permanently anchor thresholds using countersunk, non-ferrous screws to match color of thresholds. Provide stainless steel screws at aluminum thresholds.

Lead Protection: Lead wrap hardware penetrating lead-lined doors. Levers and roses to be lead lined. Apply kick and armor plates with 3M adhesive #1357, as recommended by 3M Company, on lead lined doors.

QUALITY CONTROL

Quality Assurance
Manufacturer: Obtain each type of hardware (i.e. latch, and locks, hinges, closers, etc.) from single manufacturer, although several may be indicated as offering products complying with requirements. Where hardware may be furnished by more than one supplier, provide hardware to match the preponderance of building hardware.

Supplier: A recognized architectural door hardware supplier who stocks products in their own Las Vegas warehouse in reasonable quantities used on this project and who has maintained an office and who has been furnishing hardware on similar projects in the project's vicinity for a period of at least five (5) years. Hardware supplier MUST be capable of providing comprehensive emergency repair service 24-hours a day and 7-days a week. No exceptions will be allowed. Hardware supplier shall have a local office and a local inventory of products used on this project and warehouse facilities to accommodate this project. Hardware supplier must own the inventory of products used. Wholesale distributor inventories do NOT meet this requirement. No exceptions will be allowed. Hardware supplier shall have in his employment at least one (1) Architectural Hardware Consultant (AHC) or equal who is available at reasonable times during business hours for consultation about the project's hardware and requirements to the owner, architect and contractor. Hardware supplier must be an authorized factory-direct distributor of all products specified herein. "Factory-direct" translates to having an open account and able to purchase "directly" from the specified manufacturers. No exceptions will be allowed.

Installer: Firm with 3 years experience in installation of similar hardware to that required for this project, including specific electronic hardware specified and used on this project.

Regulatory Label Requirements: Provide nationally recognized testing agency (U.L., Warnock Hersey, Factory Mutual) label or stamp on hardware for labeled openings. Where labeling requirements conflict with drawings or specifications, hardware conforming to the labeling requirements shall be provided. Conflicts and proposed substitutions shall be clearly indicated in hardware schedule.

Pre-Installation Conference: Prior to the installation of hardware, manufacturer's representatives for locks, closers and exit devices shall arrange and hold a jobsite meeting to instruct the installing contractor's personnel on the proper installation of their respective products. A letter of compliance, indicating when this meeting is held and who is in attendance, shall be sent to the Architect and Owner.

Field Quality Control
At completion of project, a qualified door and hardware professional shall inspect the hardware installation. After this inspection, a letter shall be sent to Architect reporting on conditions, verifying that hardware has been properly installed and adjusted. Any deficiencies noted shall be corrected prior to final payment.

Protection
Provide for proper protection of items of hardware until Owner accepts Project as complete.

Cleaning and Adjusting
At final completion, hardware shall be left clean and free from disfigurement. Make final adjustment to door closers and other items of hardware. Where hardware is found defective, repair, replace or otherwise correct as directed.

Adjust door closers to meet opening force requirements of Uniform Federal Accessibility Standards.

Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of space or area, return to work during week prior to acceptance of occupancy and make final check and adjustment of hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware.

Instruct Owner's personnel in proper adjustment and maintenance of door hardware and hardware finishes.

Clean adjacent surfaces soiled by hardware installation.

WARRANTY

Guarantee workmanship and material provided against defective manufacture. Repair or replace defective workmanship and material appearing within a period of one year after Substantial Completion.

Provide ten year warranty on door closer body against defects in material and workmanship from date of occupancy of Project.

Replace shortages and incorrect items with correct material at no additional cost to Owner.

SECTION 08740

ELECTRICAL LOCKING SYSTEMS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

Section Includes: Electric Locking Systems

References
- ANSI/BHMA A156.2 - Bored and Preassembled Locks and Latches.
- ANSI/BHMA A156.13 - Locks and Latches, Mortise.

Definitions Used with On-line Electronic Access Control System:
- Access Group: A list of access points and the time zone that users will be allowed access.
- Access Reader: Provides control of the access point by interfacing a card, electronic key, chip, or keypad with the system.
- Alarm Monitoring: Provides the system a status of the alarm devices.
- Distributed Architecture: Describes the operation of the system that allows the system to function with its normal routines without communications to the computers.
- Door Controller: Provides the system the interface of the reader and alarm inputs along with the relay outputs and communicates the information to the computer.
- Elevator Controller: Restricts user access to the floors by user access group.
- Operator Log-On: Computer operator that has been granted access to the system software by a user ID and password.
- Relay Control: Provides control of devices by time zones or linking events by the software.
- Site Controller: Provides the interface of 100 DCD's (Door Control Device) and 10 RCD's (Relay Control Device) with the computer.
- Site Ethernet Interface: Provides TCP/IP connectivity via an Ethernet network with any number of site control units.
- Time Zone: Start and end period along with days of the week that can be used to control user access, automatic unlocking access points, alarms inputs, reports, and relay operations.
- User: Holder of a card, Marlok key, Touch chip, or keypad ID.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Online access system utilizing HID Wiegand Swipe Reader proximity card readers with a minimum 8" normal read range as specified herein and on the project drawings.

System shall be administered from a designated point and shall communicate with each site via LVMPD existing network, direct wire, (where feasible), or dial-up modem.

On-line Electronic Access Control System: Millenium Plus for Windows

Online Electronic Access Control System: Millenium Enterprise.

System shall have capability to perform:
- Access control.
- Alarm monitoring.
- Identification badging.
- Programmable relay control.
- View events in real time.
- Print selected events in real time.
- Elevator control.
- Controlled by a computer.

Computer System Characteristics:
Millenium Application Server
- Pentium class PC (Network-ready if using workstations)
- Maximum RAM required by manufacturer
- 1 TB Hard Drive
- CD ROM drive (32x read speed)
- 1600 X 1200 32 bit color VGA card
- Two DB-9 Serial Ports
- Accurate Clock (1 to 5 minutes per year)
- Latest version of Windows and all service packs
- Microsoft SQL Server Latest Edition (minimum) in Standard or Enterprise edition

Millenium Workstation
- Network-ready Pentium class PC
- Maximum RAM required by manufacturer
- 1 TB Hard Drive
- CD ROM drive (32X read speed)
- 1600 X 1200 32 bit color VGA card
- Accurate Clock (1 to 5 minutes per year)
- Windows Latest Edition

Software Design
- Native 32-bit, multi-tasking and multi-threaded, running under Windows Latest Edition with all service packs or higher.
- Use a GUI (Graphical User Interface) based upon Windows standards, have extensive on-line help, and provide familiar icon-driven, tabbed dialog menu options.
- Perform network communications tasks via a separate integrated application running in background.
- Alarm monitoring, alarm editing, and setup applications shall require operator logon to function.

Identification Badge Software
- Include totally integrated identification badging, utilizing same database as access control system. No import or export shall be necessary. Can be added at any time with no database conversion necessary.

- Provide complete card layout capabilities, including graphic file import capability for all standard formats, and providing “drag and drop” element placement. Portrait and landscape card types in any dimensions shall be supported.
- Provide ability to design and print both sides of a card using suitable printers.
- Provide ability to print any selected database fields on card.
- Support Twain compatible devices for image capture.
- Support FlashPoint series of video capture cards.
- Support batch printing of badges.
- Support encoding of any or all of 3 high or low coercivity magnetic tracks, using suitable printers or encoders, from selected database fields.
- Support fingerprint, bar code, and signature using suitable options.

Operators Software
- Limit system operator by default operator levels.
- Capability of individual operator passwords for logging on.
- Capability of programmable operator levels. These levels shall be fully programmable as to menu items and functions available to an operator.
- Provide an automatic operator logoff delay.
- Require a logon ID different from operator name to maintain network security.

Database Software:
- Support ODBC standard and be supplied with a compatible database.
- Supplied with a database management application to allow archiving of history, database repair functions, and import/export.
- Support near-real-time import of data, and be arranged to support scheduling options for unattended operation.
- Support automatic update of user access rights as a result of import process.
- Allow for a unique industry standard ISO card number to be generated on demand as part of import process.
- Protect each database by a specially generated unique password known only internally in software.

Alarm Monitoring Software
- Support a minimum of 4 supervised alarm inputs per door controller with time zone disable feature, and a programmable shunt delay timer from 0 to 255 seconds.
- Support 3 additional non-supervised alarm inputs per door controller.
- Provide a forced-door entry with an ajar alarm. Forced-door alarm shall have a shunt delay timer of 0 to 255 seconds. Ajar alarm shall have a programmable delay timer of 1 to 255 minutes.
- Support adding name of alarm in a field minimum of 19 characters.
- Support prioritizing of alarms to 99 levels.
- Support linking specific alarms to relay control devices.
- Include a graphical alarm editing application that shall allow a user to define alarms including graphical maps. Animated icons shall be placed on maps to indicate standard alarm types such as fire and break-in. Four levels of zoom shall be provided for each alarm.
- Require acknowledgment text so personnel monitoring alarms shall provide response information.

- Include an alarm monitor application separate from main software that shall display alarms graphically in priority with which they were programmed. Application shall be able to be run from any workstation.
- Provide alarm monitor with capability to display a user portrait in response to valid or invalid access attempts.
- Provide alarm monitor with support for standard sound cards and .wav files so user defined sounds can be played for alarms.
- Log-off required to quit alarm monitor.
- Programmable requests for incident reports.
- Support up to 4 floor maps per door controller.

Client (Guard) Tour Software:
Include a guard or client tour application which can be run from any workstation on network. Provide client tour application for up to 100 tours, with a maximum of 96 intervals each.

Types of Tours Available:
- Global: Assigned to any individual card holder at time tour is selected.
- Individual: Assigned to a card holder at time of creation.
- Allow for selective filtering at device level, so as to allow multiple workstations to run different tours.

Other Software Functions:
- Capability of programmable Daylight Savings Time.
- Not allow duplication of user names or user ID.
- 18 predefined user identification fields, 10 configurable user ID field, and 1 “Note” page per user.
- Support multiple access reader technologies on same system simultaneously.
- Provide for multiple “lost card” entries so a lost access credential can be easily identified if used.
- Support a door controller address and text description name in a field minimum of 19 characters.
- Support door controllers that total an even or odd number on system.
- Support minimum of 2 relays for each door controller.
- Support unlocking a strike/magnetic lock automatically in accordance with a programmable time zone.
- Support unlocking a strike/magnetic lock device at a defined time, but only after first valid user accesses access reader.
- Capability of programming relay operation time for use with such items as a strike or magnetic lock.
- Provide an audit trail programmable by date and time range, user(s), and access reader(s).
- Notify when status of a door or relay controller changes because of a communication or device problem.
- Support programmable reports viewed on monitor or printed.
- Support programmable reports on printer in real time.
- Provide capability of sorting history events by time, dates, users, access readers, and operators.
- Have ability to print a “dossier” report, which includes a person’s portrait along with user selected database fields and notes.

- Support custom ABA and Wiegand formats for access readers.
- Support combination access readers with 1 Wiegand output.
- Support user pin number along with a card that is enabled by a time zone.
- Support a door pin number that is enabled by a time zone.
- Support anti-passback mode.
- Support relays that can be programmed to operate by a time zone, alarms or by events linked to access points.
- Have the Owner's name encrypted and displayed on monitor.
- Able to accept any 3-digit facility code of card or chip provided.
- Capabilities to archive data from hard drive to a floppy disk and be able to select dates of data being archived.
- Capability of routing system history to workstations on network such that if desired, multiple alarm monitoring stations can be maintained, each with separate alarm displays.
- Provide an option to run on a Windows supported TCP/IP network with a minimum of 10 concurrent workstations.
- Provide option of communication to sites using TCP/IP and Millenium Site Ethernet Interface.
- Advise and display on computer monitor status of door and relay controller(s) if communication or power is lost on system.

Minimum Parameters:
- System Software: Unlimited users.
- Each Site Controller: 100 access readers.
- Each system: 1,000 site controllers.
- Maximum doors: 100,000
- Number of Access Groups: Unlimited.
- Time Zones: 200.
- Holidays: 20.
- Vacation Periods: 8.

System Hardware
- System shall be able to be configured from 1 to 100 access readers for each site control unit.
- Controllers shall have capacity of memory support, including real-time clock for a minimum of 24 hours, in case of AC loss of power and battery backup is exhausted.
- System shall use a fully-distributed architecture in which system alarms, access, relays, and elevator control shall continue to function in a normal mode without computer communications.
- Site controller shall be able to communicate to computer via EIA standard RS-232, RS-485, dial-up modem, lease line, fiber optics, wireless Spread Spectrum modem, or with use of a Site Ethernet Interface, via TCP/IP protocol.
- Site controller shall have a local relay to monitor status of communications with door control units. In case of device failure relay will open, providing a means of triggering an external monitoring device.
- Site, door, relay, and elevator controller features shall have capability to be field upgraded by a firmware change. Such firmware upgrades shall be offered as needed to registered users on an exchange basis, labor not included.

- Door controller shall support any Wiegand standard based readers in any bit format up to 50 total; bit patterns fully programmable within software.
- Door controller shall read Dallas touch chip format directly without use of accessory devices.
- Door controller shall have ability to read Marlok™ metal keys and key readers without use of interface devices.
- Example supported reader types include but are not limited to: Wiegand, Mag-stripe, Bar Code, Proximity, Dallas TouchKey, Keypad, Biometrics and/or combination keypad with Wiegand/Proximity/Magnetic stripe.
- Door controller shall be able to be programmed for custom ABA formats from PC software, including ability to ignore user specified characters in format.
- Door controller shall be programmable to accept either normal or inverted strobe signals from ABA format readers.
- Same door controller shall be programmed for all access reader technologies as specified by means of PC software.
- Site controller shall buffer last 2,000 events from door controllers when computer communications has been lost or terminated.
- Each door controller shall buffer an additional 2,000 events when site controller buffer has filled
- All system controllers shall have a built-in tamper alarm to detect when a cover to controller is removed.

Door Controller
- Request to Exit input.
- Single reader input configuration.
- Located within 10 feet (3 m) of access reader.
- Function at full capacity without communications to computer, and buffer events up to a maximum of 2,000 during this period.
- Continue to function on battery backup at a minimum of 9 V DC.
- Door and relay controller shall have Form C dry contact configuration.
- Door and relay controller shall have relays with a minimum current rating of 24 V DC at 2 A with solid-state automatically re-settable over current protection for contacts.
- Door controller shall have a relay that can be programmed by software for: Valid User, Auto Activate, First User Auto Activate, Any User, Rejected User, or Alarm Options.
- Relay controller shall have relays that can be configured by software for Time Zone Activation, Timed Activation, Timed Released, First Event Activation, and First Event Released.
- Relay on door controller shall have a programmable timer and settings in software for strike and magnetic lock operation.
- Door and relay controller shall provide a dedicated tamper alarm to monitor opening of controller mounting boxes.
- Site to door controller communication conform to EIA RS-485 for a recommended total cable length of 5,000 feet (1,524 m).

Power Supply
Battery backup capable of providing power for system during temporary AC power outage. Provide a relay to notify system when there is a loss of AC power.

System Access Readers
Wiegand Output Format Readers: Output of 26-bit Wiegand format or a custom bit configuration from 13 to 50. HID 310 Classic Swipe Reader.

Door Control Device (DCD)
Description
- Designed to control a single access point.
- Contains a real-time clock and sufficient memory to provide access control independent of main PC.
- Transaction history shall be automatically buffered when not on line with PC.
- Priority event buffer assures alarms are annunciated in a timely manner even if history buffer is full.
- Power: 9 to 14 V DC, supplied by central power supply; 80 to 110 mA, depending upon reader technology. 225 mA additional required during unlock of Marlok rotating cylinder (7 seconds maximum). Accessory relays require additional 20 mA each.
- Power Protection: Reverse polarity, over voltage, transient.
- Reader Technologies Supported: Marlok key, Wiegand card (any bit format up to 50), ABA/ISO Track 2, proximity, keypad, combination reader/keypad, Dallas TouchKey and biometrics.
- Reader Interfaces Supported: Marlok, clock/data, clock/data inverted, Dallas touch and Wiegand.
- History Buffer: 2,000 transactions.
- Priority Event Buffer: 100 transactions.
- On-Board Memory and Clock Backup: 24 hours minimum.
- Maximum Users Stored in Memory: 10,000.
- Alarm Input Points: 7 total, 2-wire supervised (EOL resistor) including built-in door contact monitoring.
- Alarm Input Monitoring Circuit: Analog to digital conversion.
- Tamper Alarm: On-board switch.
- Output Relays: 2 each with Form C contacts rated 2 A, 30 V.
- Output Relay Contact Protection: Solid-state polymeric re-settable.
- Connectors: 5 mm plug-on screw terminal.
- Address Switches: Rotary, direct-reading 00 to 99.
- Communications: Multi-drop RS-485, proprietary protocol.

Operating Environment
- Between 14 degrees F and 104 degrees F (-10 degrees C and 40 degrees C).
- Less than 90 percent noncondensing humidity.
- Dimensions, Mounted in Back Box: 10-1/2 inches high x 4-3/4 inches wide x 1-3/4 inches deep (267 mm high x 121 mm wide x 44 mm deep).
- Weight, Mounted in Back Box: 5.0 pounds (2.3 kg).

Site Control Unit (SCU)
Description
- Designed to control a maximum of 100 door controllers and a maximum of 10 relay controllers.
- Normally used for a single site or building, contains a real-time clock and sufficient memory to supervise site.

- Maximum of 1,000 site controllers can be addressed in a system.
- Transaction history is automatically buffered when not on line with PC.
- Priority event buffer assures alarms are annunciated in a timely manner even if history buffer is full.
- On-board switches select operational modes.
- Power: 9 to 14 V DC, supplied by central power supply; 50 mA standby, 90 mA maximum.
- Power Protection: Reverse polarity, over voltage, transient.
- PC to SCU Communications Interface: RS-232, RS-485 4-wire, or TCP/IP.
- SCU to DCD Communications Interface: RS-485 multi-drop 2-wire.
- Modem Support: Hayes AT command set, 9,600 baud or greater.
- Supervisory Relay: Rated 2 A, 30 V Form C. Opens on-site fault.
- History Buffer: 2,000 transactions.
- Priority Event Buffer: 100 transactions.
- On-Board Memory and Clock Backup: 24 hours minimum.
- Alarms: Lost AC input.
- Tamper Alarm: On-board switch.
- Connectors: 5 mm screw terminal.
- Address Switches: Rotary, direct-reading 000 to 999.
- Operating Environment
- Between 14 degrees F and 104 degrees F (-10 degrees C and 40 degrees C).
- Less than 90 percent noncondensing humidity.
- Dimensions, Mounted in Back Box: 10-1/2 inches high x 4-3/4 inches wide x 1-3/4 inches deep (267 mm high x 121 mm wide x 44 mm deep).
- Weight, Mounted in Back Box: 5.0 pounds (2.3 kg).
- Relay Control Device (RCD)
- Power: 9 to 14 V DC, supplied by central power supply; 35 mA standby current, 20 mA additional for each relay activated.
- Memory and Clock Backup: 24 hours minimum.
- Relay Outputs: 7 Form C contacts, rated 30 V DC maximum at 2 A.
- Supervisory Function: Relay 0 on first board installed. Opens on system fault.
- Communications: Multi-drop RS-485, proprietary protocol. Auxiliary programming jack for use with Marlok AP-1 and cable for stand-alone operation.
- Tamper Alarm: On-board switch.
- Configuration Jumpers: J3, relay polarity select all 16 relays; J5, relay override select.
- Address Switch: Rotary, direct-reading 0 to 9.
- Operating Environment
- Between 14 degrees F and 104 degrees F (-10 degrees C and 40 degrees C).
- Less than 90 percent noncondensing humidity.
- Dimensions, Mounted in Back Box: 10-1/2 inches high x 4-3/4 inches wide x 1-3/4 inches deep (267 mm high x 121 mm wide x 44 mm deep).
- Weight, Mounted in Back Box: 5.0 pounds (2.3 kg).

Power Supply

- Power: 120 V AC, 60 Hz, 2 A, unswitched.
- Fuses: 2 A AC input slow-blow, 1 A AC input (export), 8 A (battery output protection).
- Output: 13.8 V DC nominal, 5 A maximum.
- Battery Backup: 2 gelled lead acid cell, 6 V DC, 8.0 Ah, supplied with power supply.

- Alarm Outputs: Cover tamper switch and AC or power supply failure (dry contacts).

Trunk Interface Unit (TIU)
- Description: Trunk interface unit provides interface between RS-232 PC serial port and site controller(s).
- Power: 120 V AC to 9 V DC power cube, 200 mA.
- Serial Input: RS-232-C, DB9 connector.
- Output: RS-485, 2 or 4-wire in 5-pin screw terminal connector.
- Indicators: LED type, power, transmit, receive.
- Protection: Reverse DC polarity, communications surges.

Elevator Control Unit (ECU)
Description
- Designed to provide access control for a maximum of 16 floors.
- Each site controller can support a maximum of 4 Elevator Control Units, giving a maximum of 64 floors per Site Controller.
- Each group of elevator control units supports a maximum of 10 elevator readers.
- Power: [120 V AC, 60 Hz, 1 A, unswitched] [220 V AC, 50 Hz, 1 A, unswitched (export)].
- Power Supply Output: 5 V DC, 1 A, for local circuit board only.
- Memory and Clock Backup: 24 hours minimum
- Relay Outputs: 16 Form C.
- Contact Ratings: 5 A, 30 V DC; 10 A, 125 V AC; 6 A, 277 V AC.
- Normal Mode: Energized.
- Override Input: Normally closed.
- Unit Address: 4 position dip.
- Alarm Inputs: 4 unsupervised.
- Tamper: Built-in switch with activation spring.

Elevator Control Device (ECD)
Description
- Designed to mount inside an elevator car.
- Contains reader and communications circuitry to interface with elevator control unit.
- Maximum of 10 elevator control devices can be used for each site controller.
- Power: 9 to 14 V DC, supplied by power cube (local) or central power supply; 80 to 110 mA depending upon reader technology.
- Power Protection: Reverse polarity, over voltage, transient.
- Reader Technologies Supported: Marlok key, Wiegand card (any bit format up to 50), ABA/ISO track 2, proximity, keypad, Dallas TouchKey, biometrics.
- Reader Interfaces Supported: Marlok, clock/data, clock/data inverted, Dallas touch, Wiegand.
- Connectors: 5 mm plug-on screw terminal.
- Address Switches: Rotary, direct-reading 0 to 9.
- Communications: Multi-drop RS-485, proprietary protocol.

Operating Environment
- Between 14 degrees F and 104 degrees F (-10 degrees C and 40 degrees C).
- Less than 90 percent noncondensing humidity.

- Dimensions, Mounted in Back Box: 10-1/2 inches high x 4-3/4 inches wide x 1-3/4 inches deep (267 mm high x 121 mm wide x 44 mm deep).
- Weight, Mounted in Back Box: 4.5 pounds (2.0 kg).

Site Ethernet Interface (SEI)

- Description: Designed to provide communications between Millenium Windows PC and site control unit(s) by means of Ethernet networks utilizing TCP/IP protocol.
- Power: 12 to 15 V DC, supplied by either central power supply or auxiliary power supply; 800 mA maximum.
- IP Address Setting: Software through RS-232 port.
- Data Backup: Nonvolatile memory.
- Network Interface: 10 base T, AUI.
- SCU Interface: RS-232-C, 9,600 baud.
- Communications Protocol (Network): TCP/IP.
- Communications Protocol (SCU Interface): Proprietary.

Operating Environment

- Between 32 degrees F and 104 degrees F (0 degrees C and 40 degrees C).
- Less than 90 percent noncondensing humidity.
- Dimensions: 7 inches high x 6 inches wide x 1-1/4 inches deep (178 mm high x 152 mm wide x 32 mm deep).
- Weight: 2.0 pounds (0.9 kg).

Wiegand Swipe Cards
Quantity of cards to be supplied to UNLV will be based on the quantity of

- door openings.
  1 - 25 door openings = 50 cards to be supplied.
- 26 - 100 door openings = 250 cards to be supplied.
- 101 - 250 door openings = 500 cards to be supplied.
- 251+ door openings = 1,000 cards to be supplied.

SUBMITTALS

Product Data: Submit manufacturer's product data, including installation instructions.

Operating and Maintenance Instructions: Submit manufacturer's operating and maintenance instructions.

Warranty: Submit manufacturer's standard warranty.

Manufacturers

- Millenium Group, Millenium SQL Access Control System

INSTALLATION GUIDELINES

Examination
Examine areas to receive electronic access control system. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

Installation
- Install electronic access control system in accordance with manufacturer's instructions by factory-trained and certified installers.
- Install system at locations as indicated on the drawings.
- Install door hardware as specified in Section 08710.
- Install electrical wiring to on-line system components as specified in Section 16100.
- Use manufacturer's supplied hardware.
- Replace defective or damaged components as directed by the Architect.
- Furnish to the Owner all required keys and keycards.

Delivery, Storage, and Handling
- Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- Storage: Store materials indoors, in a clean, dry area in accordance with manufacturer's instructions.
- Handling: Protect materials and finishes during handling and installation to prevent damage.

QUALITY CONTROL

Manufacturer Qualifications:
- Responsible for all components.
- Continuously engaged in electronic access control system construction with a minimum of 10 years successful experience.
- Able to demonstrate successful performance on comparable projects.

Responsible for system design, including:
- Preparation of engineering and production documentation.
- Development of testing program and interpretation of test results.
- Design and Manufacturing Process: ISO 9001 certified.
- Capability of providing manufacturer-employed field service personnel for installation assistance as required.
- Capability of providing 24-hour, 7 days per week technical service assistance through a toll free telephone number after acceptance of work by the Owner.
- Capability of providing manufacturer-employed field service personnel for technical service and maintenance after acceptance of work by the Owner.

Installer Qualifications
Trained and certified in installation, service and system support by the manufacturer.

Installer must have a minimum of 5 years experience with the system and have a minimum of 10 existing system installations within a 50 mile radius of the project. Installer must maintain a repair and service facility within 50 miles of the project.

Pre-installation Meeting: Convene a pre-installation meeting [2] weeks before start of installation of electronic access control system. Require attendance of parties directly affecting work of this section, including Contractor, Architect, Electrical Contractor and installer. Review installation, field quality control, adjusting, demonstration, and coordination with other work.

Field Quality Control
Test completed installation to verify each component of electronic access control system is properly installed and operating.

Cleaning and Adjusting
Adjusting
- Adjust electronic access control system as required to perform properly.
- Adjust locksets for smooth operation without binding.

Cleaning
- Clean surfaces in accordance with manufacturer's instructions.
- Use cleaners approved by manufacturer, as some cleaners may damage keylok/keyreaders.
- Do not use abrasive cleaners.

Start-up and Training
Demonstration
- Provide comprehensive on-site training to Owner’s personnel by factory-trained and certified trainers.
- Demonstrate system to Owner’s personnel.
- Train Owner’s personnel in proper operation and maintenance.

SECTION 08800

GLASS AND GLAZING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for glass and glazing.

Section Includes:

- Glass and glazing for hollow metal and wood doors.
- Glass and glazing for metal framed curtain wall.
- Glass and installation of mirrors not specified in Section 10801 - Toilet and Bath.

References

- ASTM C1036: Flat Glass.
- ASTM C1048: Heat-Treated Flat Glass - Kind FT Uncoated Glass.
- ASTM E773: Seal Durability of Sealed Insulating Glass Units.
- ASTM E774: Sealed Insulating Glass Units.
- FGMA, Flat Glass Marketing Association, Glazing Manual.
- SIGMA: Sealed Insulated Glass Manufacturers Association.
- CPSC 16 CFR Part 1201, Safety Standard for Architectural Glazing Material.
- ANSI Z97.1, Transparent Safety Glazing Material Used in Buildings.
- International Building Code (IBC), Latest edition.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Protect glazed openings from glass breakage caused by vandalism.

Perform Work in accordance with FGMA Glazing Manual, FGMA Sealant Manual, SIGMA for glazing installation methods.

Perform Work in strict accordance with requirements established by the rating agency as a condition of the fire rating assigned.

SUBMITTALS

Submit under provisions of the front end and/or general conditions.

Product Data: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements, rating requirements and special conditions applicable to safety glazing ratings.

Samples: Submit two (2) samples, eight (8) x eight (8) inch of glass types.

Manufacturer's Instructions: Indicate special installation precautions required to meet safety ratings specified.

PRODUCT STANDARDS

Glazing materials must conform to standards contained in the Flat Glass Marketing Association glazing manual.

Glass type and thickness must meet ASTM 1300 standards in combination with other applicable factors. The minimum thickness for each lite is 6 mm.

Manufacturers
- Float Glass Manufacturers
- Guardian Industries Corp..
- Pilkington
- PPG
- Saint Gobain
- Visteon

Float Glass Fabricators: Tempered, Non-Coated, Insulated
- ACI
- AFGD
- Hehr Glass
- Northwestern Industries
- Oldcastle Glass

Coated Insulated Glass Fabricators
- AFGD
- Guardian Industries Corp.
- Interpane
- Northwestern Industries
- Oldcastle Glass
- Viracon

Custom Laminated/Security Glass
- Globe Amerada
- Hehr Glass
- Northwestern Industries
- Oldcastle Glass
- Substitutions
- Under provisions of the front end and/or general conditions.

MATERIALS

Glass and glazing materials must conform to the following standards. UNLV strongly prefers clear glazing. With Owner approval, light green or light gray glass will be considered on a case by case basis.

Glass Schedule
- Curtain wall: 1" thick insulating unit, clear glass, with Low-E at exterior.
- Aluminum window: 1" thick insulating unit, clear glass, with Low-E at exterior.
- Storefront: 1" thick insulating unit, clear glass, with Low-E at exterior.
- Skylight: 1-1/16" thick insulating unit, with tinted exterior pane and clear laminated interior pane, with Low-E at exterior.
- Handrails: 3/8" thick tembered safety glass (non-structural), with Low-E at exterior.
- Steel windows: 5/8" thick insulating unit, with inner and outer lights of 3/16" annealed glass, with Low-E at exterior.

Glazing Sheets
- Primary glass, Federal Specification DD-G-451—clear and tinted float glass and wire glass
- Heat-treated glass products, Federal Specification DD-G-1403:heat-strengthened glass, tempered glass, and spandrel glass
- Coated glass products
- Laminated glass products
- Mirrors, silvering, copper coating, and protective organic coating
- Plastic glazing—acrylic, polycarbonate
- Wire glass
- Fire-rated glazing

Insulating Glass units
Sealed insulating units must be fabricated from two panes of glass, with air space between. The units must include a dual sealing system, spacer, desiccant, and corner reinforcement. Glass thicknesses and heat strengthening must be determined by manufacturer for wind loading conditions. A 10-year insulation glass warranty is required.

INSTALLATION GUIDELINES

Fabrication
Verify in the field, exact measurements before fabrication.

Examination
- Verify that openings for glazing are correctly sized and within tolerance.
- Verify that surfaces of glazing channels or recesses are clean, free of
- obstructions, and ready to receive glazing.

Preparation
- Do not install glazing when ambient temperature is less than 50 degrees F.
- Maintain minimum ambient temperature before, during and twenty-four (24) hours after installation of glazing compounds.
- Clean contact surfaces with solvent and wipe dry.
- Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- Prime surfaces scheduled to receive sealant.

Exterior: Wet/Dry Method (Tape and Sealant)
- Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with butyl sealant.

- Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
- Place setting blocks at 1/3 points with edge block no more than 6 inches from corners.
- Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.
- Install removable stops, with spacer strips inserted between glazing and applied stops, 1/4 inch below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.
- Fill gap between glazing and stop sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.
- Apply cap bead of sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

Interior: Wet/Dry Method (Tape And Sealant)
- Cut glazing tape to length and install against permanent stops, projecting 1/16 inch above sight line.
- Place setting blocks at 1/3 points with edge block no more than 6 inches from corners.
- Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
- Install removable stops, with spacer shims inserted between glazing and applied stops at 24 inch intervals, 1/4 inch below sight line.
- Fill gaps between pane and applied stop with sealant to depth equal to bite on glazing, to uniform and level line. Trim protruding tape edge.
- At acoustical locations indicated on drawings, set glass in continuous U-shaped neoprene gaskets and stop in continuous bead of non-hardening resilient sealant.

Mirrors
- Verify flatness and trueness of wall surface for installation of mirror glass.
- Coordinate installation with other trades for proper sequencing.
- Adhesive mount to wall surfaces in strict accordance with manufacturer's instructions.
- Apply adhesive in uniform coating to entire back side of mirror.

Protection
- After installation, mark pane with an 'X' by using cross streamers not touching glass.
- Keep glass face clean of any material.

Cleaning and Adjusting
- Remove glazing materials from finish surfaces.
- Remove labels after work is complete.
- Clean glass.

WARRANTY

Provide ten (10) year manufacturer's warranty under provisions of the front end and/or general conditions.

Warranty: Include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

SECTION 09020

FLOOR SYSTEMS PREPARATION TREATMENT

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

Newly installed floors shall be thoroughly cleaned and treated prior to Substantial Completion. The Contractor shall have copies of the cleaning, stripping, and sealing product Material Safety Data Sheets, and ensure that the workers are properly briefed on their contents, and comply with the provisions of the Material Safety Data Sheets.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Cleaning
Resilient and non-resilient floor surfaces shall be thoroughly cleaned with a neutral cleaning agent prior to final sealing. Neutral cleaning agents include water based cleansers that are completely soluble, and do not leave deposits or etch the finished floor surface when properly applied. Cleaning agents shall be compatible with the Franklin brand series of strippers and cleaners.

Resilient Floor Systems
Resilient floor systems include VCT and other resilient flooring. Sealing shall be accomplished using Franklin "Grand-Prix" ultra high speed floor finish. The sealing compound shall be applied on a clean dry floor. Apply the sealing compound using a clean mop and bucket. Apply three coats of “Grand-Prix” ultra high speed floor finish. Allow 20 to 30 minutes cure time between successive coats. When the final coat has been applied, allow 24 hours before ultra high speed buffing. Dry buff with a Brillo RPM Ultra High Speed Floor Pad or a Brillo "The Natural" Floor Pad. Dry buffing speed shall be 2,000 RPM to produce best results.

Non-resilient Floor Systems
Non-resilient floor systems include concrete, ceramic tile, and other non-resilient masonry floor systems. Sealing shall be accomplished using Franklin "Runway" urethane emulsion sealer. The sealing compound shall be applied on a clean dry floor using a mop or spray application. The floor surface must be completely cured prior to application. Apply three coats of Franklin “Runway” urethane emulsion sealer. Allow 30 minutes to one hour drying time between coats. The final coat shall dry 6-8 hours before being opened to traffic.

SECTION 09200

PORTLAND CEMENT PLASTER

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for Portland cement plaster (Stucco).

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Lath and plaster installations shall be detailed on the drawings, to the extent not sufficiently established by industry standards and to avoid misunderstandings. Pay attention to substrates, intersections, joints, expansion and contraction.

Avoid integral color plaster due to inconsistencies of color mixing. Apply plaster in standard gray color and finish with paint to seal and provide desired color.

Lath and plaster work shall be in accordance with the recommendations of the following:

“Portland Cement Plaster (Stucco) Manual” published by the Portland Cement Association

“Specifications for Metal Lathing and Furring” published by the Metal Lath/Steel Framing Association, a division of the NAAMM

“Plaster/Metal Framing Systems/Lath Manual” distributed by the Plastering Information Bureau of California

On major new projects, require a field constructed mock-up for verification of texture, assembly, and details.

The mockup shall be maintained at the job site until the end of the project.

Generally, remodeled plastered areas shall be plaster board with plaster finish coats as required and new plastered walls shall be the Imperial plaster board base with Imperial plaster finish.

PRODUCT STANDARDS

Expanded metal lath shall be self-furring, 3.4 lbs./sq. yd., diamond mesh, galvanized steel sheet for exterior use and wet interior areas.

Plaster on masonry shall be two coat type work and on wood or steel framing shall be three coat type work.

Mix design shall be verified before plastering operations begin and shall include alkaline resistant glass or polypropylene fiber reinforcement strands.

Plaster accessories shall be metal. Small-nose corner beads shall be fabricated of zinc alloy and have expanded flanges of large mesh diamond lath for plaster embedment. Casing beads shall be square-edge type.

Expansion joints shall be one piece type in “M” shaped configuration, with expanded metal flanges, except 2- piece type may be used where expansion exceeds the one piece capabilities.

INSTALLATION GUIDELINES

Provide for expansion in exterior and interior plaster installations. Locate expansion joints where recommended by standards, but not more than ten feet on center nor defining panels greater than 100 square feet. Re-entrant corners shall have expansion joints provided.

Moist cure Portland cement plaster in accordance with the requirement of ASTM C926, including “Annex A2 Design Considerations”

SECTION 09260

GYPSUM BOARD ASSEMBLIES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for non-load bearing metal stud framing, interior and exterior gypsum board.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General
This Section includes the following:

- Interior gypsum wallboard.
- Exterior sheathing.
- Tile backing panels.
- Non-load-bearing steel framing.

Quality Assurance
Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

Indicate design designations of specific assemblies on Drawings.

Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated per ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

SUBMITTALS

Product Data: For each type of product indicated.

Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including their locations on Drawings.

Products
General
Use products with high percentage of recycled and post-consumer content.
Where possible, use products that are produced locally and use a high content of regional materials.

Steel Suspended Ceiling and Soffit Framing
Components, General: Comply with ASTM C 754 for conditions indicated.

Steel Partition and Soffit Framing
Comply with ASTM C 754 for conditions indicated.
Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with ASTM A 653, G40, hot-dip galvanized zinc coating.

Steel Studs and Runners: ASTM C 645.
GA-600 recommends 0.0312-inch- (0.79-mm-) thick studs at fire-door frames supporting standard and heavy-weight doors, but includes an alternate detail for nested 0.0179-inch (0.45-mm) studs for standard-weight doors.
Minimum 20 gauge (Steel Stud) with minimum wall thickness of 0.0300". Studs shall be located at 16 inches on center – maximum.

Interior Gypsum Wallboard
Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
Gypsum Wallboard: ASTM C 36.
Type X: 5/8 inch thick where required for fire-resistance rated assembly.

Sheathing
Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum Corp.
Type and Thickness: 5/8 inch thick.

Tile Backing Panels
Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M.
Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, "Dens-Shield Tile Backer" manufactured by G-P Gypsum Corp.

INSTALLATION GUIDELINES

Execution
Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

Preparation
Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.
Furnish concrete inserts and other devises indicated to other trades for installation in advance of time needed for coordination and construction.

Coordination with Sprayed Fire-Resistive Materials:
Detail requirements for attaching gypsum board assemblies to construction protected by sprayed fire-resistive materials on Drawings.

Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed-on fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.

After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of gypsum board assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

Installing Steel Framing, General
ASTM C 840 includes installation requirements not included in ASTM C 754.

Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.

Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."

Installing Steel Suspended Ceiling and Soffit Framing
Suspend ceiling hangers from building structure as follows:

- Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
- Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.

Installing Steel Partition and Soffit Framing
Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.

Where studs are installed directly against dissimilar metals at exterior walls, install foam-gasket isolation strip between studs and wall.

Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent framing.

Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

Applying and Finishing Panels, General
Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

Finishing Gypsum Board Assemblies
General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:

- Level 1: Embed tape at joints in ceiling plenum areas, concealed areas unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
- Level 2 is suitable for surfaces receiving medium- or heavy-textured finishes before painting or heavy wallcoverings where lighting conditions are not critical.
- Level 3: For surfaces to receive wall covering. Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges for all exposed walls.
- Level 4 is suitable for surfaces receiving light-textured finish wallcoverings and flat paints. It is generally the standard exposed finish.
- Level 5: For surfaces to receive gloss, semi-gloss or nontextured flat paint. All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coats of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. The surface shall be smooth and free of tool marks and ridges.

Sheathing
General: Fasten glass-mat, water-resistant sheathing to supports with galvanized screws; comply with GA-253 and manufacturer's recommended spacing and referenced fastening schedule. Keep perimeter fasteners 3/8 inch from edges and ends of units.

Quality Control

Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

SECTION 09310

CERAMIC TILE

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for ceramic tile.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Flooring
Tiles are to be 12"x12" or larger of a ceramic or porceline material with a minimum 1/4" thickness. Color should be fully saturated through the thickness of the tile. All interior tile finishes will be approved by UNLV Planning and Construction Department.

ASTM Technical Data Requirements:
- Water absorption <0.5%
- Abrasive wear >100
- Breaking strength >250 lbs
- Coefficient of friction textured >=0.6
- Facial dimension range <1.5%
- Range of thickness <0.04"
- Warpage/diagonal <0.75%
- Wedging <1.00%
- Resistance to freeze/thaw cycling
- Tile floors larger than 10’-0” in any direction shall have relief joints not to exceed 10’-0” on center.

Wall Tile
Wall tile should be 8"X 8" or larger of a ceramic or porcelain material with the color fully saturated through the thickness of the tile. The specifications are the same as the floor tile.

All tile flooring and grouting shall be sealed using a water emulsion, acrylic sealer with a minimum 18% non-evaporative solids. This requirement can be waived if approved by UNLV.

Manufacturers
- Cooperativa Ceramic D'Imola
- Crossville Ceramics
- Arizona Tile

SECTION 09385

DIMENSION STONE TILE

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for dimensioned stone tile and setting materials for both floors and walls.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General
Provide stone tile installation systems and accessories as indicated on drawings, and as specified:

- Exterior and interior stone wall tile veneer installed over Steel Framing and Cement Backer Units using Latex Thin-Set Mortar, Grout and Waterproof Membrane.
- Interior floor tile

QUALITY ASSURANCE

Source Limitations for Stone: Obtain stone, regardless of finish, from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.

Installation System Manufacturer: Company specializing in installation systems/adhesives/mortars/grouts with ten years minimum experience. Obtain products from single source manufacturer to insure consistent quality and compatibility.

Installer qualifications: company specializing in installation of ceramic tile, mosaics, pavers, trim units and thresholds with 5 years documented experience with installations of similar scope, materials and design.

Pre-Installation Conference
At least three weeks prior to commencing the work attend a meeting at the jobsite to discuss conformance with requirements of specification and job site conditions. Representatives of UNLV, architect, general contractor, tile subcontractor, Installation System Manufacturer, and other parties who are involved in the scope of this installation must attend the meeting.

Project/Site Conditions
Provide ventilation and protection of environment as recommended by manufacturer.

Prevent carbon dioxide damage to installation mortars, adhesives, grouts and ceramic tile by venting temporary heaters to the exterior.

Maintain ambient temperatures not less than 50º F or more than 100º F during installation. Protect work for extended period of time and from damage by other trades. Installation with Latex Portland cement mortars requires substrate, ambient and material temperatures at least 37º F. There should be no ice on substraight. Protect Portland cement based mortars and grouts from direct sunlight, radiant heat, forced ventilation (heat & cold) and drafts until cured to prevent premature evaporation of moisture. Epoxy mortars and grouts require surface temperatures between 60º F and 90º F at time of installation.

SUBMITTALS

Submit shop drawings and manufacturers' product data:

- Submit manufacturers' installation instructions.
- Mockup of installation system demonstrating compatibility/functional relationships between ad.

Mock-ups

- Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
- Build mockups for each type of stone veneer assembly in sizes approximately 72 inches long by 72 inches high by full thickness, including face and backup.
- Include metal cap flashing, if applicable.
- Protect accepted mockups from the elements with weather-resistant membrane.
- Approval of mockups is for color, texture, and blending of stone; relationship of mortar and sealant colors to stone colors; tooling of joints; and aesthetic qualities of workmanship.

PRODUCT STANDARDS

Stone Tile
Depending on type of stone, granite (ASTM C 615), limestone (ASTM C 568), marble (ASTM C 503), Slate (ASTM C 629); travertine (ASTM C 1527). Stone shall be appropriate for interior or exterior installation:

- Cut, size/module and finish to be reviewed and approved by UNLV Planning and Construction prior to being specified.
- Back Side: Comply with requirements of UBC 1997 Section 1403.5.4.2. Units are to be ground to true up any deviations from
- plane.
- Match Architect's samples for variety, color range, finish and other stone characteristics relating to aesthetic effects.

Mortar, Grout and Adhesive Manufacturer
Depending on setting system, all mortar, grout and adhesives to meet ANSI requirements.

INSTALLATION GUIDELINES

Execution
Verify that wall and/or floor surfaces to be covered with waterproofing and stone veneer are:

- Sound and conform to good design/engineering practices; rigid, with maximum deflection of L/480 distributed uniformly over the span.
- Clean and free of dirt, oil, grease, sealers, curing compounds, form oil or loose plaster, paint, and scale.
- Level and true to within: 1/4 in. in 10 ft.
- Advise General Contractor and Architect of any surface or substrate conditions requiring correction before stonework commences. Beginning of work constitutes acceptance of substrate or surface conditions.

Surface Preparation
Cement Backer Unit (CBU): must be attached in accordance with manufacture's instructions and ANSI 108.11. All board joints and corners must be taped with 2" glass fiber mesh tape embedded with a skim coat of Laticrete 4237 Latex Mortar, or equal mixed with Laticrete 211 Filler Powder or Laticrete 254 Multi-Purpose Thin-Set Mortar before receiving waterproof membrane.

Installation-Stone Tile
General: Install in accordance with ANSI A108.5 Standard for Ceramic Tile installation and TCA Method

W244-03. Cut and fit tiles neatly around corners, fittings, and obstructions. Perimeter tile to be minimum half tile. Chipped, cracked, and split tile edges are not acceptable. Make joints even, straight, plumb and of uniform width to tolerance +/- 1/16" over 8ft.

Thin Bed Method: Clean back of stone with a damp sponge to remove dust and foreign debris before installing with latex thin-set mortar adhesive. Use the appropriate size notched trowel (minimum 1/4" x 3/8") to insure full mortar coverage of the stone. "Burn in" mortar on substrate with the flat side of the trowel before notching to insure good surface contact. "Back butter" the backside of each stone with the flat side of the trowel before placement into the mortar bed to insure good contact and full coverage. Lift pieces of stone occasionally to verify full mortar coverage on back. Spread only as much adhesive as can be covered in 10 - 20 minutes or while adhesive surface is still wet and tacky. Beat each piece into adhesive with a rubber mallet to insure full bedding and flat, level joints. Clean off excess adhesive from the surface of the stone with a damp cloth or sponge while the adhesive is fresh. Allow stone to set 24 hours before grouting.

Grout: Verify grout joints are free of dirt, debris or tile spacers. Sponge or wipe dust/dirt off the face of the stone. Pack joints full and free of voids/pits with rubber grouting float; "squeegee" excess grout from tile faces using edge of rubber float and diagonal strokes (at 45º angle to direction of joints); Cleaning Portland cement grouts – Pull/drag sponge diagonally across tile faces/joints to remove remaining grout film and allow tile work to dry. Hardened grout film or haze should be removed within 24 hours.

Expansion joints: Provide expansion joints as per TCA EJ171-03 and as specified by architect. Existing joints in subsurface must be carried through the stone work. Install expansion joints where stone abuts restraining surfaces, such as perimeter walls, curbs, columns, corners, pipe penetrations, and any other vertical / horizontal transitions. Use LATICRETE Latasil Silicone Sealants for these joints.

Adjusting: Correction of defective work for a period of 1 year following substantial completion, return to job and correct all defective work. Defective work includes, without limitation, tiles broken in normal abuse due to deficiencies in setting bed, loose tiles or grout, and all other defects which may develop as a result of poor workmanship or defective materials.

Protection
Provide protection of newly installed waterproof membrane, even if covered with thin-bed stone installation against exposure to rain or other water for a minimum of 5 days per adhesive manufacturer's recommendations. Protect latex thin-set mortars and grout from rain for 48 hours per mortars manufacturer's recommendations. Close areas to other trades and traffic until tile being installed has set firmly.

Extend period of protection of stone work at lower temperatures per adhesive manufacturer's recommendations.

Cleaning and Adjusting
Clean excess mortar from surface with water as work progresses. Perform cleaning while mortar is fresh and before it hardens on surfaces. Take care to not contaminate joints while cleaning prior to grouting. Sponge and wash tile diagonally across joints. Polish with clean dry cloth. Remove grout haze following recommendation of mortar and grout additive manufacturer. Do not use acids for cleaning.

WARRANTY

Standard 10 year system warranty.

Start-up and Training
Submit maintenance data. Include cleaning methods, cleaning solutions recommended, stain removal methods, and polishes and waxes recommended.

SECTION 09400

TERRAZZO FLOORING

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SUMMARY

This section contains design criteria for and information for standard cementitious terrazzo flooring.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General
Cementitious terrazzo, over either sand bed, structural metal deck or as determined.

QUALITY ASSURANCE

Installer Qualifications: An installer who is a contractor member of NTMA.

NTMA Standards: Comply with NTMA Guide Specification and written recommendations for terrazzo type indicated unless more stringent requirements are specified.

Mockups: Install mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

Install terrazzo mockups of at least 100 sq. ft. (9 sq. m) of typical flooring and base condition for each color and pattern in locations directed.

Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion

SUBMITTALS

Product Data: For each type of terrazzo and accessory indicated.

Shop Drawings: Include terrazzo fabrication and installation requirements. Include plans, elevations, sections, component details, and attachments to other Work.

Samples: For each type, color, and pattern of terrazzo and accessory required and in size indicated below:

Terrazzo: 6-inch-square Samples.

Precast Terrazzo: 6-inch- square Samples.

Accessories: [6-inch- (150-mm-)] <Insert size> long Samples of each exposed strip item required.

Requiring NTMA membership may prequalify installers. See "Installer Considerations" Article in the Evaluations in Division 9 Section "Terrazzo." Coordinate below with qualification requirements retained in "Quality Assurance" Article.

Qualification Data: For Installer.

PRODUCT STANDARDS

Products
Cementitious Terrazzo
- Cementitious Terrazzo Type: Sand cushion.
- Thickness: As indicated.

Materials:
- Portland Cement: ASTM C 150, Type 1.

Color for Exposed Matrix: As required by mix indicated.

Sand: ASTM C 33.

Marble Chips: Complying with NTMA standards and of type and in gradation required for mix indicated.

Matrix Pigments: Pure mineral or synthetic pigments, alkali resistant, color stable, and compatible with matrix binder.

Sand-Cushion-Terrazzo Isolation Membrane: Polyethylene sheeting, ASTM D 4397, 4 mils (0.1 mm) thick; or No. 15 unperforated roofing felt complying with ASTM D 226, Type 1.

Divider-Strip Adhesive: Adhesive recommended by manufacturer for this use.

Mixes:
Cementitious Terrazzo Installed over Metal Deck or Underbed: Reinforced concrete, as specified in Division 3 Section "Cast-in-Place Concrete."

Cementitious Terrazzo: Comply with NTMA Guide Specification for terrazzo type indicated for matrix and marble-chip proportions and mixing.

Accessories:
Heavy-Top Divider Strips: Straight or angle type with anchoring device and in depth required for topping thickness indicated.

Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material, thickness, and color of divider strips and in depth required for topping thickness indicated.

Accessory Strips: Match divider-strip width, material, and color, unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:
- Base bead and base dividers.
- Nosings for stair treads and landings.
- Edge beads for exposed edges of terrazzo.

Precast Cementitious Terrazzo
Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- Precast & Building Supply Corp.
- Precast Terrazzo Enterprises, Inc.
- Romoco Precast Terrazzo Products.
- Wausau Tile, Inc.; Terra Paving Products Division.

Precast Terrazzo Base Units: Minimum 3/4-inch- (19-mm-) thick, reinforced-cementitious terrazzo units cast in maximum lengths possible, but not less than 36 inches (900 mm).

Outside Corner Units: With finished returned edges at outside corner.

Precast Terrazzo Units: Comply with NTMA's written recommendations for fabricating precast cementitious terrazzo units in sizes and profiles indicated. Reinforce units as required by unit sizes, profiles, and thicknesses and as recommended by manufacturer.

Stair Treads and Landings.

INSTALLATION GUIDELINES

Clean substrates to produce clean, dry, and neutral substrate for terrazzo application.

Bonded Systems: Remove substances that might impair bond of terrazzo system, including oil, grease, and curing compounds.

Concrete: Roughen concrete substrates before installing terrazzo system according to NTMA's written recommendations.

Dust Control: Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.

Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

Cementitious Terrazzo Installation, General: Comply with NTMA's guide specification for terrazzo type indicated.

Seed additional stone chips in matrix to uniformly distribute chips on surface.

Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.

Accessory Installation: Install according to NTMA's written recommendations.

Divider and Accessory Strips: Install in locations indicated.

Divider Strips: Install at centers of joists or beams supporting metal deck.

Control-Joint Strips: Install back to back directly above substrate control joints.

Abrasive Strips: Install with surface of abrasive strip positioned 1/32 inch higher than terrazzo surface.

Construction Tolerances: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet.

Repair: Cut out and replace terrazzo areas that evidence lack of bond with substrate or underbed, including areas that emit a "hollow" sound if tapped. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

Cleaning and Adjusting
Remove grinding dust from installation and adjacent areas.

Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow to dry thoroughly.

Seal terrazzo surfaces according to NTMA's written recommendations. Apply sealer according to sealer manufacturer's written instructions.

SECTION 09402

EPOXY TERRAZZO FLOORING

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SUMMARY

This section contains design criteria for and information for thin-set epoxy flooring.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General
- Thin-set epoxy terrazzo.
- Thin-set, precast epoxy terrazzo base and tread units.

QUALITY ASSURANCE

Installer Qualifications: A qualified installer (applicator) who is acceptable to epoxy terrazzo manufacturer to install manufacturer's products.

Engage an installer who is certified in writing by terrazzo manufacturer as qualified to install manufacturer's products.

Engage an installer who is a contractor member of NTMA.

Source Limitations: Obtain primary terrazzo materials through one source from a single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

Source Limitations for Aggregates: Obtain each color, grade, type, and variety of aggregate from one source with resources to provide materials of consistent quality in appearance and physical properties.

Mockups: Install mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

For epoxy terrazzo, install mockups of at least 100 sq. ft. of typical flooring and base condition for each color and pattern in locations directed by Architect.

Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to terrazzo including, but not limited to, the following:

Project Conditions
Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.

Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.

Close spaces to traffic during epoxy terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.

Control and collect dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

SUBMITTALS

Product Data: For each type of terrazzo and accessory indicated.

Shop Drawings: Include terrazzo fabrication and installation requirements. Include plans, elevations, sections, component details, and attachments to other Work. Show layout of the following:
- Divider and control- and expansion-joint strips.
- Base and border strips.
- Abrasive strips.
- Stair treads, risers, and landings.
- Precast terrazzo jointing and edge configurations.
- Terrazzo patterns.

Samples for Initial Selection: Master Terrazzo Technologies color plates showing the full range of colors and patterns available for each terrazzo type indicated.

Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

Products
Use products with high percentage of recycled and post-consumer content.

Epoxy Terrazzo
Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following Basis-of-Design. Submit equal or better products for approval under provisions of the General Conditions of the Contract, 2.5 Substitutions.

Basis-of-Design:
- Manufacturer: Master Terrazzo Technologies, LLC
- Thickness: 3/8 inch.

Materials:
Flexible Reinforcing Membrane: Manufacturer's resinous membrane for substrate crack preparation and reflective crack reduction.

Reinforcement: Fiberglass scrim, if required.

Primer: Morricite primer, 100% solids, moisture insensitive. No solvents containing primers are allowed.

Epoxy Resin: Manufacturer's standard recommended for use indicated and in color required for mix indicated.

If desired for decorative effect, insert requirements for aggregates other than marble chips, such as glass and granite; consult manufacturers for recommendations.

Divider-Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use and acceptable to terrazzo manufacturer.

Finishing Grout: Resin based.

Seal Coat: SealOn low viscosity, clear acrylic finish. Provide maintenance instructions in the maintenance and operation manuals.

Mix: Comply with NTMA's "Guide Specification for Epoxy Terrazzo" and manufacturer's written instructions for component proportions and mixing.

Divider and Accessory Strips
- Thin-Set Divider Strips: Angle or T type, 1/4 inch deep.
- Brass may react with resin matrices. Verify that material retained below is acceptable to terrazzo manufacturers.

Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material, thickness, and color of divider strips and in depth required for topping thickness indicated.

Accessory Strips: Match divider-strip width, material, and color unless otherwise indicsated. Use the following types of accessory strips as required to provide a complete installation:

Precast Epoxy Terrazzo
Manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following. Submit equal or better products for approval under provisions of Substitutions requirements Section 01600.

Master Terrazzo Technologies.
Precast Epoxy Terrazzo Base Units: 3/8 inch thick; cast in maximum lengths possible, but not less than 36 inches; with rounded, finished top edge.

Precast Epoxy Terrazzo Stair Treads: 1/2 inch thick with rounded nosing edge.

INSTALLATION GUIDELINES

Execution
Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

Preparation
Clean substrates of substances that might impair epoxy terrazzo bond, including oil, grease, and curing compounds.

Provide clean, dry, and neutral substrate for terrazzo application. Determine dryness characteristics by performing moisture tests recommended by terrazzo manufacturer.

Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

Epoxy Terrazzo Installation
Comply with NTMA's written recommendations for terrazzo and accessory installation.

Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
Prepare membrane according to manufacturer's written instructions before applying substrate primer.

Primer: Apply to terrazzo substrates according to manufacturer's written instructions.

Indicate strip spacings and locations on Drawings or revise paragraph below.

Divider and Accessory Strips: Install in adhesive setting bed without voids below strips.

Control-Joint Strips: Install back to back directly above substrate control joints.

Install with 1/4-inch gap between strips and install sealant in gap.

Abrasive Strips: Install with surface of abrasive strip positioned 1/16 inch higher than terrazzo surface.

Fine Grinding: Grind with 120 or finer grit stones until all grout is removed from surface. Repeat rough grinding, grout coat, and fine grinding if large voids exist after initial fine grinding. Produce surface with a minimum of 70 percent aggregate exposure.

Remove and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

Construction Tolerances: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet.

Precast Epoxy Terrazzo
Set units using method recommended by NTMA and manufacturer unless otherwise indicated. Set units with alignment level and true to dimensions, varying 1/8 inch maximum in length, height, or width.

Treads: Back-butter for full contact with substrate.

Seal joints between units with joint sealants.

Cleaning and Adjusting
Remove grinding dust from installation and adjacent areas.

Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow to dry thoroughly.

Seal surfaces according to NTMA's written recommendations. Apply sealer according to sealer manufacturer's written instructions.

Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure terrazzo is without damage or deterioration at time of Substantial Completion.

UNLV | PLANNING & CONSTRUCTION

Technical Design Guidelines

SECTION 09512

ACOUSTICAL TILE CEILINGS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

Section Includes Suspended metal grid ceiling system and acoustical panels.

SUBMITTALS

Submit under provisions per owner requirements.

Coordination Drawings
Submit reflected ceiling plans, prepared by installer for installation purposes, drawn accurately to scale and coordinated with related mechanical, electrical, fire sprinkler and other work above, penetrating, or connected to acoustical ceiling. Show ceiling suspension members, method of anchorage to building structure of hangers, and ceiling-mounted work including light fixtures, diffusers, grilles, fire sprinkler heads and special moldings. Scale 1/4 inch = 1 foot 0 inches minimum.

Product Data
Submit manufacturer's data on metal grid system components, suspension trim system and acoustic units.

Samples
Submit two (2) samples illustrating material and finish of acoustic units of each panel and tile type and two (2) samples, 6 inches long, of suspension system main runner, cross runner and edge trim.

Manufacturer's Installation Instructions
Indicate special procedures, perimeter conditions requiring special attention and anchorage requirements.

PRODUCT STANDARDS

References:
- ASTM C635: Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
- ASTM C636: Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
- ASTM E84: Test Method for Surface Burning Characteristics of Building Materials.
- ASTM E580: Installation of Ceiling Suspension Systems requiring Seismic Restraint.
- International Building Code (IBC), Latest adopted edition.

QUALITY ASSURANCE

Manufacturer
Company specializing in manufacture of ceiling suspension system and ceiling tile with three (3) years minimum experience.

Installer
Company with three years minimum experience.

Regulatory Requirements
Conform to IBC for fire rated assembly and combustibility requirements for materials.

Fire Performance Characteristics
Identify components with markings of applicable testing organization.

Surface Burning Characteristics
- Tested in accordance with ASTM E 84.
- Flame Spread: 25 or less
- Smoke Developed: 50 or less.

Fire Resistance Ratings
Indicated by reference to design designations in UL Fire Resistance Directory, tested per ASTM E 119

Suspension System
- Armstrong's 15/16 "Prelude" Exposed Tee System or USG's Donn DX
- System with downward access removable T, components die cut and interlocking with hemmed edges.
- Grid manufactured from commercial quality cold rolled steel with galvanized coating.

Rating
Heavy-Duty in accordance with ASTM C635.

Accessories
Provide edge trim, hanger wires, support channels and other accessories as required for a complete system in size and configuration shown on drawings and in accordance with IBC requirements.

Exposed Trim and Accessories
Formed steel finished to match grid.

Hangers and Supports
Galvanized steel. Hangers not less than 12 gauge.

Finish
Factory finished, white.

Ceiling Struts
Pre-manufactured struts, specifically designed for horizontal restraint of suspended ceiling systems, similar to USG'S Donn Compression Posts. Site fabricated posts of 1/2 inch and 3/4 inch EMT may be used if fabricated and installed in accordance with ICBO Evaluation Report ER-4071 and acceptable to the governing authority.

Acoustical Panels
- USG's "Radar - ClimaPlus" - Illusion two/24, 2 x 4 scored to 2 x 2, 3/4 inch thick, mineral fiber lay-in acoustical tile.
- Edge: Square for 15/16 inch grid.
- Ratings: NRC of .55, STC of 35 to 39.
- Color: White.

Manufacturers
Suspension System
- USG Interiors.
- Armstrong.

- Chicago Metalic Corp.
- Or an approved equal

Acoustic Panels
- U.S.G. interiors.
- Armstrong.
- Celotex Corporation.
- Or an approved equal

MATERIALS

Extra Material
Provide two (2) cartons of each type of ceiling panel installed.

INSTALLATION GUIDELINES (INCLUDES PREPARATION)

Examination
Verify that existing conditions are ready to receive work.

Verify that layout of hangers will not interfere with other work.

Coordinate installation in areas containing major ductwork.

Beginning of installation means acceptance of existing conditions.

Preparation
Do not install acoustical ceilings until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

Schedule installation of acoustic units after interior wet work is dry.

INSTALLATION

Install system in accordance with IBC Standards, ASTM C636 and ASTM E580 and as supplemented in this Section.

Install system capable of supporting imposed loads to a deflection of 1/360 maximum and in accordance with the details on the drawings.

Install after major above ceiling work is complete. Coordinate the location of hangers with other work.

Supply hangers or inserts for installation to installers of work of Section
05314 and 05316 with instructions for their correct placement. If metal deck is not supplied with hanger tabs, coordinate the installation of hanger clips during steel deck erection. Provide additional hangers and inserts as required. Submit detail of hanging/block reinforcement to Architect prior to commencing work.

Hang system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

Where ducts or other equipment prevent the regular spacing of hangers, trapeze above or below interfering members.

Locate system on room axis per reflected plan.

Do not eccentrically load system, or produce rotation of runners.

Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 6 inches of each corner, or support components independently.

Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

Form expansion joints as required. Form to accommodate plus or minus one inch movement. Maintain visual closure.

Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.

Install acoustic units level, in uniform plane, and free from twist, warp and dents.

Install hold-down clips to retain panels tight to grid system within 10 ft of exterior doors.

Provide lateral force bracing consisting of splayed wire restraints and struts as required by IBC and ASTM C636 and ASTM E580.

Four No. 12 gauge wires secured to main runners within 2 inches of cross runner intersection and splayed 90 degrees from each other at an angle not exceeding 45 degrees from the plane of the ceiling.

Struts fastened to the main runner extending to and fastening to structure above. Place struts 12 feet on center in both directions
with the first point within 6 feet from each wall.

QUALITY CONTROL

Environmental Requirements
Maintain uniform temperature of minimum 60 degrees F, and humidity of 20 to 40 percent prior to, during, and after installation.

Tolerances
Variation from Flat and Level Surface: 1/8 inch in 10 ft.

WARRANTY

Minimum one (1) year warranty per contract for installation and workmanship. Manufacturer shall provide standard warranty for all materials.

SECTION 09651

RESILIENT FLOOR TILE

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

Section Includes floor tile, resilient base, rubber stair tread, riser, landing and stringer, and rubber landing flooring in elevators.

SUBMITTALS

Product Data: Submit manufacturer's data on specified products.

Samples: Submit four (4) samples, 12 x 12 inches (nominal) in size, illustrating color and pattern for each floor tile and base.

Samples: Submit four (4) samples of base material for each color specified.

Operation and Maintenance Data
Submit cleaning and maintenance data under provisions of Section 01700.

Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

Manufacturer’s representative to provide a physical maintenance training demonstration to Owner’s maintenance staff.

PRODUCT STANDARDS

References
- ASTM E648 - Critical Radiant Flux of Floor Covering systems Using a Radiant Heat Energy Source.
- ASTM E662 - Specific Optical Density of Smoke Generated by Solid Materials.
- ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile.
- International Building Code (IBC), 2003 Edition.
- Regulatory Requirements
- Conform to IBC for flame/ fuel/smoke rating requirements of resilient flooring in accordance with ASTM E648 and E662.

Manufacturers
Flooring Tile:
- Altro Quartz Flooring Tile by Altro Safety Floors, Ltd.: Distributor Compass Concepts, Inc. (800) 543-6033.
- Ricket Quartz Floor tile by “Rickett” a Knight Company: Distributor Scorpion Group (702) 558-9600.
- Or an approved equal.

Base:
- Roppe.
- Allstate.

- Burke.
- Johnsonite.

Rubber Tread, Riser, Landing and Stringers
- Johnsonite.
- Or an approved equal.

MATERIALS

Floor Tile:
- Vinyl Composition Tile: ASTM F1066, Class 2, Composition 1; 12 x 12 inch size, 1/8 inch thick, in colors and patterns as shown on drawings..

Base Materials:
- Base: ASTM F-1861, Type TS , Group 1, thermoset vulcanized extruded rubber; 4 inch high; 1/8 inch thick; standard toe, color as shown on drawings.
- Provide premolded exterior corners.

Rubber Tread, Risers and Stringers:
- Tread: Johnsonite Hammer Textured rubber stair tread and riser, HTR, .210 inches thick tapered, color #06, Diablo Red.
- Stringer: Johnsonite rubber stringer, to match tread and riser, color #06, Diablo Red.
- Landing: Johnsonite rubber tile to match tread and riser, color #06 Diablo Red.

Accessories or Special Features:
Environmental Requirements
- Store materials for three (3) calendar days prior to installation in area of installation to achieve temperature stability.
- Maintain ambient temperature required by adhesive manufacturer three (3) calendar days prior to, during, and 24 hours after installation of materials.

Accessories:
- Subfloor Filler
- Cementitious, non-shrinking latex fortified hydraulic cement patching compound recommended by flooring material manufacturer.

Primers and Adhesives:
- Waterproof; types recommended by flooring manufacturer.

Edge Strips:
- Vinyl edge strips appropriate for transition to adjacent material.
- Provide reducer strips where elevation difference occurs.

Sealer and Wax:
- Types recommended by flooring manufacturer.

INSTALLATION GUIDELINES

Examination
Verify that surfaces are smooth and flat with maximum variation of 1/8 inch in 10 ft, and are ready to receive Work.

Verify concrete floors are dry to a maximum moisture content of seven percent, and exhibit negative alkalinity, carbonization, or dusting. Test to ensure a moisture vapor transmission does not exceed 5 lb./1,000 sq.ft/24 hours (ASTM F 1869)

Verify metal stair system is complete and not subject to additional construction loading.

Beginning of installation means acceptance of existing substrate and site conditions.

Preparation
Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

Apply, trowel, and float filler to leave a smooth, flat, hard surface.

Prohibit traffic from area until filler is cured.

Vacuum clean substrate.

Apply primer to surfaces.

Installation: Floor Tile
Install in accordance with manufacturers' instructions.

Mix tile from container to ensure shade variations are consistent.

Quarter turn tile per manufacturer’s recommendations

Spread only enough adhesive to permit installation of materials before initial set.

Set flooring in place, press with heavy roller to attain full adhesion.

Install tile to square grid pattern with all joints aligned.

Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.

Install edge strips at unprotected or exposed edges, and where flooring terminates.

Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

Install flooring under movable partitions without interrupting floor pattern.

Install feature strips, edge strips, and floor markings where indicated. Fit joints tightly.

Installation: Base Material
Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.

Miter internal corners. At external corners, use premolded units. At exposed ends use premolded units.

Install base on solid backing. Bond tight to wall and floor surfaces.

Scribe and fit to door frames and other interruptions.

Install toeless base at carpet flooring. Install standard toe base at all other locations.

QUALITY CONTROL

Protection
Prohibit traffic on floor finish for 48 hours after installation.

Cleaning and Adjusting
Remove excess adhesive from floor, base, and wall surfaces without damage.

Clean, seal, and apply protective polish to the floor and base surfaces in accordance with manufacturer's instructions for initial maintenance.

SECTION 09652

RESILIENT SHEET FLOORING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for resilient sheet flooring.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Quality Assurance
Installer Qualifications: A qualified installer who employs workers for this Project that are competent in heat-welding techniques required by manufacturer for floor covering installation.

Engage an installer who employs workers for this Project that are trained or certified by floor covering manufacturer for heat-welding techniques required.

Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

Project Conditions
Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive floor tile during the following time periods:

48 hours before installation.

After post-installation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

Extra Materials
Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each color, pattern, and type of floor covering installed.

SUBMITTALS

Product Data: For each type of product indicated.

Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch sections of each different color and pattern of floor covering required.

For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

Heat-Welded Seam Samples: For each flooring product and welding bead color and pattern combination required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

Qualification Data: For Installer.

Maintenance Data: For floor coverings to include in maintenance manuals.

PRODUCT STANDARDS

Products
Use products with high percentage of recycled and post-consumer content.

Sheet Vinyl Floor Covering
Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following Basis-of-Design.

- Basis-of-Design: Armstrong World Industries, Inc.: Translations #31735.
- Sheet Vinyl Floor Covering with Backing.
- Type (Binder Content): I, minimum binder content of 90 percent.
- Wear-Layer Thickness: Grade 1.
- Overall Thickness: .080.
- Interlayer Material: None
- Backing Class: Class B (nonfoamed plastic).
- Color and Pattern: As selected by Architect from manufacturer's full range.
- Wearing Surface: Embossed.
- Sheet Width: 6.5 feet.
- Seaming Method: Heat welded
- Fire-Test-Response Characteristics:
- NFPA 101, "Life Safety Code," requires that floor covering materials in exits and in accesses to exits meet critical radiant flux limitations in certain occupancies. Authorities having jurisdiction may impose other restrictions. Delete paragraph above and subparagraph below if not applicable or revise to suit Project.
- Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

INSTALLATION GUIDELINES

Installation Materials
Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by floor covering manufacturer for applications indicated.

Adhesives: Water-resistant type recommended by manufacturer to suit sheet vinyl floor covering and substrate conditions indicated.

Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Heat-Welding Bead: Solid-strand product of floor covering manufacturer.

Color: Match floor covering.

Integral-Flash-Cove-Base Accessories:

Cove Strip: 1-inch radius provided or approved by floor covering
manufacturer.

Cap Strip: Square metal, vinyl, or rubber cap provided or approved by floor covering manufacturer.

Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of floor coverings, and in maximum available lengths to minimize running joints.

Execution
Coordinate requirements specified in other Sections for subfloor construction and tolerances to ensure that they are appropriate for sheet vinyl floor coverings selected.

Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor coverings.

Proceed with installation only after unsatisfactory conditions have been corrected.

Preparation
Extensive surface preparation is required over substrates from which existing floor coverings have been removed. Requirements vary among manufacturers. Insert requirements to suit Project.

Prepare substrates per manufacturer's written recommendations to ensure adhesion of floor coverings.

Concrete Substrates:
Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

Moisture Testing:
Perform anhydrous calcium chloride test. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

Do not install floor coverings until they are same temperature as space where they are to be installed.

INSTALLATION

Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.

Match edges of floor coverings for color shading at seams.

Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

Heat-Welded Seams: Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.

Cleaning and Adjusting
Remove adhesive and other blemishes from floor covering surfaces.

Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

Apply protective floor polish to surfaces that are free from soil, visible adhesive, and blemishes if recommended in writing by manufacturer.

Cover floor coverings with undyed, untreated building paper until Substantial Completion.

SECTION 09680

CARPET

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SUMMARY

Carpeting is to be either 12 ' or 6 ' wide broadloom Antron type nylon of a level loop type construction with a minimum 26 oz yarn weight. The following is a typical manufacturers specification. All flooring materials and interior finishes are to be approved by the UNLV Department of Planning and Construction.

PRODUCT STANDARDS

- Construction: Patterned Loop
- Machine Gauge: 1/10
- Yarn Content: Dupont Certified Antron Legacy Nylon
- Tufted Pile Height: 218" Presheared Tufted Yarn Weight: 28 oz./sq.yd.
- Approximate Total Weight: 64 oz./sq.yd.
- Primary Back: Reinforced woven polypropylene.
- Secondary Back: Action Bac* or Unitex
- Back Width: 12 feet and 6 feet
- Static Control: Antron* Legacy Nylon reduces static electricity below the level of human sensitivity for the lifetime of the carpet.
- Soil Retardant: Dura Tech* Pattented soil resistant technology
- Antimicrobial: Sanitized antimicrobial treatment
- Flammability ratings: Pass Methenamine Pill Test (DOC FF1-70)
- Flooring Radiant Panel Test: Exceeds minimum requirement and is suitable for health and all other occupancies as required by HEW.
- NBS Smoke Chamber Test: Exceeds Test requirements
- with a MSOD of 350 or lessin the flaming mode

WARRANTY

Warranty: 10 year warranty

SECTION 09841

ACOUSTICAL WALL PANELS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for acoustical fabric wrapped wall panels.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General

Back mounted acoustical wall panels with fabric covering.

QUALITY ASSURANCE

Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

Source Limitations: Obtain acoustical wall panels through one source from a single manufacturer.

Fire-Test-Response Characteristics: Provide acoustical wall panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials, fabrication, and installation.

Project Conditions
Environmental Limitations: Do not install acoustical wall panels until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

Lighting: Do not install acoustical wall panels until a permanent level of lighting is provided on surfaces to receive acoustical wall panels.

Air-Quality Limitations: Protect acoustical wall panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

Field Measurements: Verify locations of acoustical wall panels by field measurements before fabrication and indicate measurements on Shop Drawings.

Extra Materials
Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Fabric: For each fabric, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 yards.

Acoustical Wall Panel Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than 5 attachment devices.

SUBMITTALS

Product Data: For each type of panel edge, core material, and mounting indicated.

Shop Drawings: For acoustical wall panels. Include mounting devices and details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Include elevations showing panel sizes and direction of fabric weave and pattern matching. Indicate panel edge and core materials.

Coordination Drawings: Show intersections with lighting fixtures, air outlets and inlets, access panels, and other adjacent work.

Samples for Verification: For the following products. Prepare Samples from same material to be used for the Work.

Fabric: Full-width by 36-inch- long Sample from dye lot to be used for the Work, and as follows:
- With specified treatments applied.
- Show complete pattern repeat.
- Mark top and face of fabric.
- Panel Edge: 12-inch- long Sample showing edge profile, corner, and finish.
- Core Material: 12-inch- square Sample showing corner.
- Mounting Device: Full-size Sample.
- Sample Panels: No larger than 36 by 36 inches. Show joints and mounting methods.

PRODUCT STANDARDS

Products
Core Materials: Glass-Fiber Board: 6-7 pcf compressed fiberglass core with 1/8” thick 16 pcf Hi Impact fiberglass facing.

Retain core material in paragraph below for tackable face layer over glass-fiber board core. This layer provides tackability and some impact resistance and only minimally decreases noise reduction performance of glass-fiber board core.

Core materials listed above are standard for acoustical wall panels. It may be possible to add other acoustical components such as sound absorbing, blocking, or reflective backings, facings, or septums. Although they reduce acoustical performance, wood nailing strips within the core may be available from some manufacturers.

Back-Mounted Edge-Reinforced Acoustical Wall Panels with Glass-fiber Core, AWP-1
Basis-of-Design:
- Manufacturer: LBI/Boyd
- Product: APS-100 Hi Impact panel

Panel Construction: Manufacturer’s standard panel construction consisting of facing material laminated to front face, edges, and back border of dimensionally stable, rigid glass-fiber board core; with edges chemically hardened or impact resistant to reinforce panel perimeter against warpage and damage.

Higher board density in first paragraph below is typical, especially for cores of 3/4 to 1 inch (19 to 25 mm) thick or less. Lower board density or a combination of mineral-fiber boards with different densities may be recommended by manufacturers to decrease the weight of thicker cores.

Facing Material: Fabric from same dye lot; color and pattern as indicated by manufacturer's designations Edit list below to coordinate with option retained in paragraph above.

Applied Treatments: Stain resistance.

Nominal Core Density: 6 to 7 lb/cu.ft.

Nominal Core Thickness and Overall System NRC: 1.125" and not less than NRC 0.80, for Type A mounting as tested by an NVLAP accredited facility.

Panel Edge Detail: Square.

INSTALLATION GUIDELINES

Fabrication
Sound-Absorption Performance: Provide acoustical wall panels with minimum NRCs indicated, as determined by testing per ASTM C 423 for mounting type specified and tested by an NVLAP accredited facility.

Acoustical Wall Panels: Panel construction consisting of facing material adhered to face, edges and back border of dimensionally stable core; with rigid edges to reinforce panel perimeter against warpage and damage.

Fabric Facing: Stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other foreign matter. Applied with visible surfaces fully covered.

Where square corners are indicated, tailor corners. Heat seal vinyl fabric seams at corners.

Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, sags.

Measurement in paragraph below is CISCA and industry consensus; however, some manufacturers fabricate to plus or minus 1/32 inch (0.79 mm).

Back-Mounting Devices: Concealed on backside of panel, recommended to support weight of panel, with base-support bracket system where recommended by manufacturer for additional support of panels, and as follows:

Execution
Examine fabric, substrates and conditions, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of acoustical wall panels.

Proceed with installation only after unsatisfactory conditions have been corrected.

INSTALLATION

Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

Comply with acoustical wall panel manufacturer's written instructions for installation of panels using type of concealed mounting accessories indicated or, if not indicated, as recommended by manufacturer. Anchor panels securely to supporting substrate.

Match and level fabric pattern and grain among adjacent panels.

Variation from Level and Plumb: Plus or minus 1/16 inch.

Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

Cleaning and Adjusting

Protection

Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that acoustical wall panels are without damage or deterioration at time of Substantial Completion.

Replace acoustical wall panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

SECTION 09910

PAINTING

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SUMMARY

Provide painting and surface preparation for interior and exterior unfinished surfaces as scheduled.

Provide painting and surface preparation of exposed mechanical and electrical piping, conduit, ductwork, and equipment.

Provide repainting and surface preparation at areas of remodeling.

Provide painting of entire surface where patch painting is required.

SUBMITTALS

Submit product data, samples, 4 foot by 4 foot mockup of each color,
and a composition breakdown of the proposed paint product to ensure compliance with UNLV Paint Composition Standards. Products and paint systems must be approved by UNLV.

Categories include:
- Interior, vinyl wall paint, flat sheen, water base
- Interior, semi-gloss, water base
- Interior, low sheen, water base
- Interior/exterior, non-blocking, gloss, water base
- Interior/exterior, flat, water base
- Interior, semi-gloss, solvent base
- Exterior, semi-gloss, solvent base.
- Interior/exterior, high gloss, solvent base.

Detailed formulation specifications of the UNLV Paint Composition Standards are found at the end of this section.

Material Data Safety Sheets (MSDS) must be supplied to UNLV for all paint products used.

Prior to project close-out, a corrected room finish schedule, color guide, manufacturer’s color code information for all finished surfaces, and extra stock consisting of 1 unopened gallon of each product and color of paint used is to be provided to UNLV.

PRODUCT STANDARDS

First-line commercial-quality products for all coating systems.

Regulations
Compliance with Nevada VOC and environmental regulations.

Products
All paint products shall meet the requirements of the UNLV Paint Composition Standards as follows.

The contractor shall remove from campus all hazardous materials and waste generated by the painting activity.

MATERIALS

Concrete Unit Masonry Block Fillers
- Factory-formulated high-performance latex block fillers.

Exterior Primers
- Exterior Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.
- Exterior Galvanized Metal Primer: Factory-formulated galvanized metal primer for exterior application.

Interior Primers
- Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
- Interior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.
- Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.
- Interior Zinc-Coated Metal Primer: Factory-formulated galvanized metal primer.

Exterior Finish Coats
- Exterior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for exterior application.
- Exterior Low-Luster Acrylic Paint: Factory-formulated low-sheen (eggshell) acrylic-latex paint for exterior application.
- Exterior Semigloss Acrylic Enamel: Factory-formulated semigloss waterborne acrylic-latex enamel for exterior application.
- Exterior Full-Gloss Acrylic Enamel for Concrete, Masonry, and Wood: Factory-formulated full-gloss waterborne acrylic-latex enamel for exterior application.
- Exterior Full-Gloss Two-Component, Aliphatic Polyurethane, colored, for Ferrous and Other Metals: Factory-formulated full-gloss Two-Component, Aliphatic Polyurethane for exterior application.
- Exterior Full-Gloss Alkyd Enamel: Factory-formulated full-gloss alkyd enamel for exterior application.

Interior Finish Coats
- Interior Semigloss Acrylic Enamel: Factory-formulated semigloss acrylic-latex enamel for interior application.

Interior Wood Stains and Varnishes

- Open-Grain Wood Filler: Factory-formulated paste wood filler applied at spreading rate recommended by manufacturer.
- Open-Grain Wood Filler: Factory-formulated paste wood filler applied at spreading rate recommended by manufacturer.
- Interior Wood Stain: Factory-formulated alkyd-based penetrating wood stain for interior application applied at spreading rate recommended by manufacturer.
- Clear Sanding Sealer: Factory-formulated fast-drying alkyd-based clear wood sealer applied at spreading rate recommended by manufacturer.
- Interior Waterborne Clear Satin Varnish: Factory-formulated clear satin acrylic-based polyurethane varnish applied at spreading rate recommended by manufacturer.
- Interior Waterborne Clear Gloss Varnish: Factory-formulated clear gloss acrylic-based polyurethane varnish applied at spreading rate recommended by manufacturer.

Manufacturers

Acceptable manufacturers

- Dunn-Edwards
- Sherwin-Williams
- Products that comply with the UNLV Paint Composition Standards.

Installation Guidelines

All painted walls shall have a high-end, acrylic, scrubbable paint. If a solvent based paint is not used for shelving and doors, it must be at least an acrylic non-blocking paint. Exterior painted masonry surfaces shall be properly sealed and prepared, and finished with a 100% acrylic flat finish. Exterior metal must be properly prepared and finished with a suitable system. Occupied facilities shall be painted with brush and roller. Use of spray paint application is prohibited in occupied facilities.

INSTALLATION

All material used shall be delivered to the job site in clean, sealed, original containers with all labels and other markings intact. Material will be stored in the area designated and all storage areas will be kept neat, clean, and locked.

Protect the work area as well as adjacent areas and materials, lawns, shrubbery and other areas not to be painted with suitable covering.

Remove cover plates and protect hardware and adjacent surfaces.

All surfaces to be painted or finished shall be thoroughly dry and cured and free of dirt, dust, grease, oil, and other foreign matter.

All voids, cracks, nicks, etc., will be repaired with appropriate patching material and finished flush with surrounding surfaces.

Marred or damaged shop coats on metal shall be spot primed with appropriate metal primer.

Steel and iron preparation may necessitate removal of mill scale and/or rust by sandblasting or sanding

New aluminum and galvanized metal surfaces must receive a solvent wash prior to application of material, and a test sample of the complete painting system should be applied and checked for adhesion before the job begins.

Preparation
All work shall be performed by experienced, trained, and supervised crafts persons to assure finished work of first class quality and durability.

All work shall be done under favorable weather conditions or the work shall be suitably protected from the weather.

Every precaution will be taken to prevent fires. At the end of each day's work all oily rags, empty containers and combustible material shall be removed from the premises.

All paints and coatings shall be mixed and applied strictly in accordance with the manufacturer's printed instructions.

All material shall be applied evenly to achieve manufacturer's recommended dry film thickness, and shall be free of runs, sags, skips and other defects.

Provide field-applied mock-ups of each color and finish selected on actual surfaces to be painted.

Test sample area for adhesion for each type of paint.

Sand before painting until smooth and flat and sand between coats.

All undercoats shall be tinted to approximate the finish coat.

Paint entire surface where patch painting is required.

Recoat areas which show bleed-through or defects.

Freshly painted areas shall be properly vented to aid drying.

Cleaning and Adjusting

Upon completion of the work remove all equipment, excess materials and debris, remove all paint splatters from adjacent surfaces and glass and leave the area in a neat and orderly condition.

Touch-up damaged surfaces at completion of construction.

QUALITY CONTROL

Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:

Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.

Testing agency will perform appropriate tests for the following characteristics as required by Owner:

Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove non-complying paint from Project site, pay for testing, and repaint surfaces previously coated with the non-complying paint. If necessary, Contractor may be required to remove non-complying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

SECTION 09960

HIGH PERFORMANCE COATINGS

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SUMMARY

This section contains design criteria for and information for high performance coatings.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General
Includes surface preparation and field application of high-performance coatings.

QUALITY ASSURANCE

Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each color and type of coating required. Comply with procedures specified in PDCA P5.

Wall Surfaces: Apply samples on at least 100 sq. ft. of wall surface.

Final approval of finishes will be made from benchmark samples.

Approved benchmark samples may become part of the completed Work if undisturbed at time of Substantial Completion.

Project conditions
Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 and 95 deg F (7 and 35 deg C).

Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

Allow wet surfaces to dry thoroughly before proceeding with or continuing coating operation.

Work may continue during inclement weather only if areas and surfaces to be coated are enclosed and temperature within the area can be maintained within limits specified by manufacturer during application and drying periods.

Extra Materials
High-Performance Coatings: Full, unused containers equal to [5] <Insert number> percent of each material and color applied, but not less than 1 gal. (3.785 L) or 1 case, as appropriate.

SUBMITTALS

Product Data: For each type of product indicated.

Samples: Manufacturer's color charts showing full range of colors available for each type of finish material indicated.

Products
Provide high performance coating products per individual application and need.

Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

Manufacturers listed distribute products nationally:
- Carboline Company (Carboline).
- DuPont Company; High Performance Coatings (DuPont).
- ICI Dulux Paints; Devoe Coatings (ICI).
- International Protective Coatings; Courtaulds Coatings (International).
- Moore, Benjamin & Co. (Moore).
- Pittsburgh Paint; PPG Industries, Inc. (PPG).
- Rust-Oleum Corporation (R-O).
- Sherwin Williams; Industrial and Marine Coatings (S-W).
- Tnemec Company, Inc. (Tnemec).

Materials
Material Compatibility: For each finish indicated, provide separate component coat materials of one manufacturer that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

Material Quality: Provide manufacturer's best-quality material for each coating material specified.

Show locations of various coating colors on Drawings or in schedules.

Colors: As selected from manufacturer's full range.

Block Filler: Acrylic or epoxy block filler of topcoat manufacturer.

Primer: Acrylic or epoxy primer of topcoat manufacturer recommended in writing by manufacturer for use with intermediate and topcoats and substrate indicated under environmental conditions indicated.

Intermediate Coat: Epoxy intermediate coat of topcoat manufacturer recommended in writing for use with primer, and topcoat, and substrate indicated under environmental conditions indicated.

Exterior High-Performance Topcoats
- High-Gloss Polyurethane: High-gloss, aliphatic polyurethane enamel.
- Nonferrous Metal Substrates: 9800 System Urethane High Build Mastic Coatings.
- Concrete Masonry Unit and Metal Substrates: 97-84XX Series.
- Ferrous Metal Substrates: Corothane II Satin B65W400 Series.
- Concrete or Masonry (Other Than Concrete Masonry Unit) and Ferrous Metal Substrates: 3359 Waterborne Acrylic.
- Concrete Masonry Unit and Metal Substrates: Series 29 Tufcryl Acrylic Emulsion.

Interior High-Performance Topcoats
Severe-Environment, High-Gloss Epoxy:
- Wood and Nonferrous Metal Substrates: Corlar 26P High Solids Epoxy Enamel.
- Concrete or Masonry (Other Than Concrete Masonry Unit) and Ferrous Metal Substrates
- Concrete Masonry Unit Substrates: Tile Clad II High Solids B62WZ Series B60V3.

Moderate-Environment, High-Gloss Epoxy:
- Concrete Masonry Unit Substrates: Corlar 26P HB DTM High Build Epoxy Enamel.
- Concrete Masonry Unit Substrates: Devran 250 Direct to Metal Gloss Epoxy.
- Concrete Masonry Unit Substrates: M36/M37 Polyamide Epoxy Gloss Coating.
- Nonferrous Metal Substrates: 9300 System Heavy-Duty Epoxy Finish.

Moderate-Environment, Semigloss Epoxy:
Concrete and Masonry (Other Than Concrete Masonry Unit) Substrates: 888 2-Component Polyamide Epoxy.
Concrete Masonry Unit Substrates: Devran 224 HS High Build Epoxy Enamel.

Installation Guidelines
Application
General: Application of coatings indicates Applicator's acceptance of surfaces and conditions.

Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.

If a potential incompatibility of primers applied by others exists, obtain the following from primer Applicator before proceeding:

Cleaning: Before applying high-performance coatings, clean substrates of substances that could impair bond of coatings. Remove oil and grease before cleaning.

Provide barrier coats over incompatible primers or remove primers and reprime substrate.

Wood Substrates: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Smoothly sand surfaces exposed to view and dust off.

Immediately on delivery, prime edges, ends, faces, undersides, and backsides of wood to be coated.

Ferrous-Metal Substrates: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.

Nonferrous-Metal Substrates: Clean nonferrous and galvanized surfaces. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

Coating Application:
Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.

Apply coatings to exposed surfaces, including areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place, and maintain system integrity and provide desired protection.

Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.

Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.

Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.

If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.

Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.

At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

SECTION 10100

VISUAL DISPLAY BOARDS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria and information for visual display boards.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

This section includes:
- Porcelain enamel markerboards.
- Tackboards.
- Trim, chalkrail and accessories.

References
- ASTM A424 - Steel Sheets for Porcelain Enameling.
- ASTM B221 - Aluminum & Alloy Extrusions.
- ASTM C208 - Insulating Board.
- ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- ANSI A208.1 - Particle Board.
- Porcelain Enamel Institute - Performance Specifications for Porcelain Enamel Chalkboards.
- International Building Code (IBC), Latest Edition.

SUBMITTALS

Shop Drawings
Indicate wall elevations, dimensions, joint locations, special anchor details.

Product Data
Provide manufacturer's information on chalkboards, markerboards, tackboards, trim and accessories.

Samples
- Submit five (5) samples of each illustrating materials and finish, color, and texture of chalkboard and trim and tackboard.
- Submit manufacturer's installation instructions.

Maintenance Data
- Submit maintenance data.
- Include maintenance information on regular cleaning and stain removal.

Product Standards
- Regulatory Requirements
- Conform to IBC requirements for flame/fuel/smoke rating of for cork covered tackboards in accordance with ASTM E84.

Markerboards
- Similar to Lemco, Model No. 254 porcelain enamel markerboard.
- 28 gauge sheet steel face pressure laminated to core.
- 1/2 inch particle board core.
- Extruded aluminum factory fabricated frame with continuous marker trough and maprail and matching accessories. Aluminum channel shall be not less than .062 inch wall thickness.
- Marker Trough: 2-5/8 inch blade type aluminum marker trough, continuous full length of board with 1 inch radius ends at each corner.
- Maprail: 1 inch high, continuous full length of board, with 3/4 inch X 1/4 inch natural cork insert and endstops.
- Manufacturer's standard brackets for concealed, mechanical mounting.
- Finish: White steel board with clear anodized trim.
- Provide 4 foot high and in lengths shown on drawings.

Tackboards
- Similar to Lemco, Model No. 3358 vinyl fabric on cork and fiber board tackboard.
- Cloth supported vinyl fabric meeting Class A (0-25) flame spread.
- 1/4 inch cork laminated to 3/8 inch fiberboard core.
- Manufacturer's standard brackets for concealed, mechanical mounting.
- Extruded aluminum factory fabricated frame.
- Finish: Shall be selected by Architect from manufacturer's standard selection.
- Provide 4 foot high in lengths as shown on drawings.

Manufacturers
- Lemco.
- Claridge Manufacturing Company.
- Tri-Adco.
- Greensteel Division Advanced Equities, Inc.
- Substitutions: Under provisions of Section 01630.

Materials
- Steel Sheet: ASTM A424, Type I, commercial quality.
- Aluminum Extrusions: ANSI/ASTM B221.
- Cork: Fine grain natural cork, homogeneous composition.
- Fiber Board: ASTM C208, cellulosic, dry type.
- Particle Board: ANSI A208.1; wood shavings set with waterproof resin binder, sanded faces.
- Adhesives: Type recommended by manufacturer.

INSTALLATION GUIDELINES

Inspection
- Verify that surfaces and internal wall blocking are ready to receive work, and opening

dimensions are as instructed by the manufacturer.
- Beginning of installation means acceptance of substrate construction.

Installation
- Install markerboards and tackboards in accordance with manufacturer's instructions.
- Establish top of perimeter frame at 84 inches above finished floor unless noted otherwise.
- Secure units level and plumb.
- Butt markerboard panels tight with concealed spline to hairline joint.

Cleaning
- Clean writing surfaces in accordance with manufacturer's instructions.
- Cover writing surfaces with protective cover, taped to frame.
- Remove protective cover at Date of Substantial Completion.

SECTION 10125

DISPLAY CASES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for interior display cases.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General

- Illuminated display cases: Glazed cabinet with adjustable shelves.
- Provide anchorage of display cases capable of withstanding the effects of earthquake motions determined according to IBC.

Quality Assurance
Installer Qualifications: An authorized representative of manufacturer for installation and maintenance of units required for this Project.

Source Limitations: Obtain each type of product through one source from a single manufacturer.

Project Conditions
Field Measurements: Verify recessed openings by field measurements before fabrication and indicate measurements on Shop Drawings.

SUBMITTALS

Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for display cases.

Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

- Show location of tack assembly seams and joints.
- Include sections of typical trim members.

Wiring Diagrams: Power, signal, and control wiring for illuminated units.

Samples for Initial Selection: For units with factory-applied color finishes as follows:

Qualification Data: For Installer.

Maintenance Data: For tack assemblies to include in maintenance manuals.

PRODUCT STANDARDS

Products
Use products with high percentage of recycled and post-consumer content.

Tack Assemblies
Natural-Cork Tack Assembly: 1/4-inch- thick, natural cork sheet factory laminated to 1/4-inch thick hardboard backing.

Display Case
Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- Claridge Products & Equipment, Inc.

Accent Series Recessed Display and Trophy Case
- Recessed, Plywood-Framed Cabinet: Factory-fabricated cabinet, with top, bottom, and sides fabricated from hardwood veneer plywood; with tack assembly on back inside surface, glazed doors at front, and 2-by-2-inch extruded-aluminum angle with access trim on face to cover edge of recessed opening.
- Veneer Species: Maple with transparent finish.
- Aluminum Finish: Color anodic.
- Accent Trim: Selected by the Architect from full range of Manufacturer's standard colors.
- Glazed Sliding Doors: 6-mm-thick tempered glass; unframed; with extruded-aluminum top and bottom track; supported on nylon or ball-bearing rollers; with plastic top guide and rubber bumpers. Equip each door with ground finger pull and adjustable cylinder lock with two keys.
- Number of Doors: Three pair.
- Shelves: 6-mm-thick tempered glass; supported on adjustable shelf standards and supports.
- Shelf Width: 12 inches.
- Number of Shelves: Three full lenght.
- Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112; recess mounted in rear surface. Provide standards full height of display case.
- Tack Surface: Natural-cork tack assembly, Color: No.1132 Black.
- Illumination System: Concealed top-lighting system consisting of fluorescent-strip fixtures. Include lamps and internal wiring with single concealed electrical connection to building system. Coordinate electrical characteristics with power supply provided.
- Ballasts: Low-temperature, high-power-factor, low-energy, fluorescent lamp ballasts that comply with CBMA standards and carry its label.
- Width: 48 inches, full width of cabinet.
- Depth: 8 inches.

Aluminum Finishes
Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.

- Color: Fluorocarbon Coating: AA-MA 2605.2.
- Resin: 70% PVDF Kynar 500
- Color: Duranar XL Coating; UC51713 XL Pewter.

Acceptable Coating Manufacturers:

- PPG Industries, Inc.
- Valspar Corporation
- BASF

Materials

- Hardboard: AHA A135.4, tempered.
- Particleboard: ANSI A208.1, Grade 1-M-1, made with binder containing no urea formaldehyde.
- Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
- Hardwood Plywood: HPVA HP-1, made with adhesive containing no urea formaldehyde.
- Cork Sheet: MS MIL-C-15116-C, Type II.
- Natural Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish.
- Extruded-Aluminum Bars and Shapes: ASTM B 221, Alloy 6063.
- Clear Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality q3, with exposed edges seamed before tempering, and 6 mm thick, unless otherwise indicated.
- Fasteners: Provide screws, bolts, and other fastening devices made from same material as items being fastened, except provide hot-dip galvanized, stainless-steel, or aluminum fasteners for exterior applications. Provide types, sizes, and lengths to suit installation conditions. Use security fasteners where exposed to view.

INSTALLATION GUIDELINES

Fabrication

- Fabricate display cases to requirements indicated for dimensions, design, and thickness and finish of materials.
- Use metals and shapes of thickness and reinforcing to produce flat surfaces, free of oil canning, and to impart strength for size, design, and application indicated.
- Fabricate cabinets and door frames with reinforced corners, mitered to a
- hairline fit, with no exposed fasteners.
- Fabricate shelf standards plumb and at heights to align shelf brackets for level shelves.

Execution
- Examine walls, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of work.
- Examine roughing-in for electrical power system to verify actual locations of connections before installation of illuminated units.
- Examine walls and partitions for proper backing for display cases.
- Examine walls and partitions for suitable framing depth where recessed units will be installed.
- Proceed with installation only after unsatisfactory conditions have been corrected.

Installation
- General: Install units in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- Recessed Display Cases: Attach units to wall framing with fasteners at not more than 16 inches o.c.
- Attach aluminum trim over edges of recessed display cases and conceal grounds and clips. Attach trim with fasteners at not more than 24 inches o.c.

Cleaning and Adjusting
- Adjust doors to operate smoothly without warp or bind and contact points meet accurately. Lubricate operating hardware as recommended by manufacturer.
- Touch up factory-applied finishes to restore damaged or soiled areas.

SECTION 10155

TOILET COMPARTMENTS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for toilet enclosures, urinal screens, and shower stall doors.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Toilet Partitions
Phenolic or solid plastic, color impregnated throughout the assembly, with a 15-year warranty; Ceiling mounted units.

Submittals
Submit product data for each type of product indicated. Include construction details, material descriptions, dimensions of individual components, and profiles and finishes.

Manufacturers
Subject to compliance with the design requirements, provide products by Santana Products, Inc. or an approved equivalent.

Materials
Provide door, panel, and pilaster in solid, high-density polyethylene (HDPE) panel material, not less than l" thick, with eased edges and with homogenous color and pattern throughout the thickness of the material.

Provide full-height (continuous) type aluminum brackets.

Provide extruded-aluminum strips fastened to the exposed bottom edges of the components to prevent burning.

Provide overhead cross bracing for ceiling-hung units fabricated from solid polymer.

Installation Guidelines
Provide the manufacturer's standard ceiling-hung units with corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for connection to structural support above the finished ceiling. Provide assemblies that support pilasters from the structure without transmitting the load to the finished ceiling. Provide sleeves (caps) at the pilaster tops to conceal anchorage.

Coordinate structural support with structural drawings.

Provide in-swinging, 24" wide doors for standard toilet compartments and out-swinging, 36" wide doors for accessible compartments.

Provide self-closing type doors that can be adjusted to hold them open at any angle up to 90 degrees.

Provide a latch and keeper designed for emergency access and with a combination rubber-faced door strike and keeper.

Provide a coat hook with rubber- tipped bumper, sized to prevent the door from hitting compartment-mounted accessories.

Provide a door bumper with a rubber-tipped bumper at out-swinging doors.

Provide a door pull at out-swinging doors that complies with accessibility requirements. Provide them on both sides of the door at accessible compartments.

Accessories or Special Features
Provide the manufacturer's standard design, heavy-duty operating hardware and accessories in a chrome-plated brass finish.

Provide the manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware with theft-resistant-type heads. Provide hex-type bolts for through-bolt applications. Use hot-dipped, galvanized, or other rust-resistant, protective-coated steel for concealed anchors.

SECTION 10410

DIRECTORIES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for building directories.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General
Design should complement the building. Size and location of directory and any display boards should be coordinated with the UNLV Planning and Construction and the User.

Adequate sizes shall be established to allow for building growth and sufficient sets of letters shall be provided with the units. Size of letters and tactile marking to comply with ADA requirements shall be considered.

Units shall be vandal proof construction.

Product Standards
Consultant shall propose to UNLV Planning and Construction.

Installation Guidelines
Mounting shall be concealed and vandal proof.

SECTION 10431

SIGNAGE

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for interior panel signs.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General
- Interior panel signs.
- Signage accessories.

Quality Assurance
Verify availability and applicability either of workers trained and approved by signage manufacturer or of authorized representatives of signage manufacturer before retaining either option below and the related "Qualification Data" paragraph in Part 1 "Submittals" Article.

Source Limitations: Obtain each sign type through one source from a single manufacturer.

Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

Signage required to be accessible to people with disabilities must comply with requirements in the ADA, Section 703, or with requirements of authorities having jurisdiction, whichever are more stringent. Many areas of the U.S. have adopted amendments to the ADA and model codes. Verify local requirements and, if desired, insert applicable requirements below.

Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:
- Illuminated Exit Signs: Refer to Division 16.
- Fire Doors
- Room Capacity
- Elevator Signs
- Stairway Identification
- Live Load Capacity
- Signs for Accessible Spaces
- Signs indicating the storage of Hazardous Materials

Project Conditions
Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate

measurements on Shop Drawings.

Submittals
Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.

Provide message list for each sign, including large-scale details of wording, lettering, artwork and braille layout.

Samples for Verification: For each type of sign, include the following Samples to verify color selected:

Panel Signs: Full-size Samples of each type of sign required.

Approved samples will not be returned for installation into Project.

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

Panel Signs
General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.

Manufacturers:
- Kroy Sign System, Inc.

Product: Low Profile System with square corners, clear non glare acrylic backed photopolymer lense with reverse painted double borders.

A sign schedule should be included at end of Part 3 or on Drawings to clearly indicate graphic content of each sign. For signs required to comply with ADA Accessibility Guidelines, indicate in a sign schedule colors that produce a light-on-dark or dark-on-light contrast between characters and their background.

Graphic Content and Style: Provide sign copy that complies with requirements indicated in UNLV standards for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.

ADA Accessibility Guidelines and ICC/ANSI A117.1 require tactile and braille characters to be raised a minimum of 1/32 inch (0.8 mm) from face of sign.

Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.

Panel Material: Manufacturers standard

Raised-Copy Thickness: Not less than 1/32 inch.

Accessories
Reflective film is usually required for exterior applications; retain paragraph below if applicable.

Mounting Methods: Use double-sided vinyl tape fabricated from materials that are not corrosive to sign material and mounting surface.

Sign Schedule (Sample)

Provide Standard UNLV Signage as Follows:
- Each Office: 4 1/2” x - 8 1/2” with labeling
- Each Laboratory Door: 7” x 11 3/4” with hazard graphic and labeling
- Each Hazardous Waste Room Door: 7” x 11 3/4” with hazard graphic and labeling
- Each Chemical Storeroom Door: 7” x 11 3/4” with hazard graphic and labeling
- Each Unisex Restroom: #2385224 - 8 3/4” x - 8 3/4” with graphic and labeling
- Each Men’s Room: #2385222 - 8 3/4” x - 8 3/4” with graphic and labeling
- Each Women’s Room: #2385223 - 8 3/4” x - 8 3/4” with graphic and labeling
- Emergency Exit Signage, 6 per floor: 11 3/4” x - 11 3/4” with graphic and labeling. Graphics to be supplied by the University.
- Each Classroom Door: 7” x 11 3/4” with graphic and labeling
- Auditorium Entry Door: 7” x 11 3/4” with graphic and labeling
- Stairs: #2385227 - 8 3/4” x - 8 3/4” with graphic and labeling.
- No Smoking, at all exterior doors: #2385226 - 8 3/4” x - 8 3.4” with graphic and labeling
- In Case of Fire Use Stairs, at all elevator entry doors: #2424403 - 8 3/4” x - 8 3/4” with graphic and labeling.
- TDD symbol, 6 per floor: #2424703 - 8 3/4” x - 8 3/4” with graphic and labeling.
- Hearing Loss, total of 6: #2424603 - 8 3/4” x - 8 3/4” with graphic and labeling.
- Assisted Listening, at all entry doors to classrooms and auditorium: #2424503 - 8 3/4” x - 8 3/4” with graphic and labeling.
- All Remaining Room Doors: 4 1/2” x - 8 1/2” with labeling
- Directional Signage, 10 per floor: 11 3/4” x - 11 3/4” with graphic and labeling.

Exit Stairs:
- Comply with Uniform Fire Code 1210.4 Stairway Identification Appendix 1-C.
- Labeling shall indicate roof access, the floor level and the upper and lower terminus of the stairway.

INSTALLATION GUIDELINES

Execution
Examine substrates, areas, and conditions, with Installer present, for compliance with

requirements for installation tolerances and other conditions affecting performance of work.

Verify that items provided under other sections of Work are sized and located to accommodate signs.

Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.

Proceed with installation only after unsatisfactory conditions have been corrected.

Installation
General: Locate signs and accessories where indicated, see details for typical placement. Use mounting methods of types described and in compliance with manufacturer's written instructions.

Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.

Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:

Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

Where panel signs are scheduled or indicated to be mounted on glass, provide matching plate on opposite side of glass to conceal mounting materials.

Cleaning and Adjusting
After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

SECTION 10505

METAL LOCKERS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for metal lockers.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Summary

- All-welded, corridor metal lockers.
- Locker benches.

Quality Assurance
Accessibility Requirements:

- Provide not less than 1 shelf located no higher than 48 inches (1219 mm) above the floor for forward reach.
- Provide 1 shelf located at bottom of locker no lower than 15 inches (381 mm) above the floor for forward reach.
- Provide hardware that does not require tight grasping, pinching, or twisting of the wrist, and that operates with a force of not more than 5 lbf (22.2 N).

SUBMITTALS

Product Data: For each type of product indicated.

Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

Include locker identification system.

Samples: For each exposed finish.

PRODUCT STANDARDS

Products
Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

Basis-of-Design Product: The design for each metal locker specified is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

All-Welded Metal Lockers

- Art Metal Products, Div. of Fort Knox Storage Co.; Champ Corridor Lockers.

- DeBourgh Mfg. Co.; Sentry Corridor/Personnel Lockers.
- List Industries Inc.; Marquis Protector Single-Point Latch Corridor Lockers.
- Lyon Workspace Products; All-Welded Lockers.
- Penco Products, Inc., Subsidiary of Vesper Corporation; All-Welded Lockers.

Locker Arrangement: To be determined per project.

Body: Assembled by welding body components together. Fabricate from unperforated, cold-rolled steel sheet with backs 0.0428 inch (1.1 mm) thick, and tops, bottoms, sides, and shelves 0.0528 inch (1.35 mm) thick.

Frames: Channel formed; fabricated from 0.0528-inch- (1.35-mm) thick, cold-rolled steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.

Locker Base: Structural channels, formed from 0.0528-inch- (1.35-mm-) thick, cold-rolled steel sheet; welded to front and rear of side-panel frames.

Doors: One-piece; fabricated from 0.0677-inch- (1.7-mm-) thick, cold-rolled steel sheet; formed into channel shape with double bend at vertical edges, and with right-angle single bend at horizontal edges.

Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.

Door Style: Perforated vents.

Hinges: Self-closing; welded to door and attached to door frame with not less than 2 factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

Continuous Hinges: Manufacturer's standard, steel continuous hinge.

Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry resistant.

Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks or padlocks; positive automatic and prelocking.

Latch Hooks: Equip [doors 48 inches (1219 mm) and higher with 3 latch hooks and doors less than 48 inches (1219 mm) high with 2 latch hooks; fabricated from minimum 0.1116-inch- (2.8-mm-) thick steel; welded to full-height door strikes; with resilient silencer on each latch hook.

Latching Mechanism: Manufacturer's standard rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

Equipment: Equip each metal locker with identification plate and the following, unless otherwise indicated:

- Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
- Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
- Triple-Tier Units: One double-prong ceiling hook.
- Coat Rods: For each compartment of single-tier metal lockers.

Locker Benches
Bench Tops: Manufacturer's standard 1-piece units, of the following material, minimum 9-1/2 inches (240 mm) wide by 1-1/4 inches (32 mm) thick, with rounded corners and edges:
- Laminated maple with one coat of clear sealer on all surfaces, and one coat of clear lacquer on top and sides.

Fixed Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:
- Color: As selected by Architect from manufacturer's full range.
- Tubular Steel: 1-1/4-inch- (32-mm-) diameter steel tubing, with 0.1265-inch- (3.2-mm-) thick steel flanges welded at top and base; with baked-enamel finish; anchored with exposed fasteners.

Steel Sheet Finishes
Baked-Enamel Finish: Immediately after cleaning, pretreating, and phosphatizing, apply manufacturer's standard thermosetting baked-enamel finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness.

Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

MATERIALS

Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS) Type B, suitable for exposed applications.

Expanded Metal: ASTM F 1267, Type II (flattened), Class I, 3/4-inch (19-mm) steel mesh, with at least 70 percent open area.

Fasteners: Zinc- or nickel-plated steel, slotless-type exposed bolt heads, and self-locking nuts or lock washers for nuts on moving parts.

INSTALLATION GUIDELINES

Fabrication
General: Fabricate metal lockers square, rigid, and without warp; with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch.

Form body panels, doors, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.

Provide fasteners, filler plates, supports, clips, and closures as required for a complete installation.

Execution

General: Install level, plumb, and true; shim as required, using concealed shims.

Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion, using concealed fasteners.

Freestanding Locker Benches: Place benches in locations indicated on Drawings.

Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

Warranty

Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

Failures include, but are not limited to, the following:

- Structural failures.
- Faulty operation of latches and other door hardware.
- Damage from deliberate destruction and vandalism is excluded.
- Warranty Period for All-Welded Metal Lockers: Lifetime from date of Substantial Completion.

SECTION 10520

FIRE PROTECTION SPECIALTIES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for fire protection specialties.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Place fire extinguisher cabinets in locations that are highly visible and readily accessible, in compliance with local building codes, and as directed by the Fire Marshall. Provide mounting brackets for extinguishers in non-public spaces, such as mechanical rooms, where cabinets are not needed. Fire extinguishers must carry the appropriate Underwriters Laboratory label.

Submittals
The contractor must submit product literature and shop drawings that indicate mounting condition and location.

Product Standards
Products must conform to applicable local building, fire, and accessibility codes.

Manufacturers
Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to J.L. Industries or an approved equivalent.

Materials
Provide pressurized, multi-purpose, dry chemical extinguishers, with a 101b. capacity and a minimum U.L. rating of 4A-60BC. The cylinder must be heavy duty steel, with a red enamel finish.

Provide carbon dioxide extinguishers, with a minimum U.L. rating of 10BC. The cylinder must be high-pressure aluminum, with a red enamel finish.

Fire extinguisher cabinets must be enameled steel boxes, with trim, frames, doors and accessories. Recessed mounting is preferred unless existing conditions require surface mounting. Trim must be flat at recessed mounting locations. Door and trim materials must be:

- Enameled steel, baked enamel finish
- Aluminum, anodized finish
- Stainless steel, AISI No. 4 bright directional finish
- Doors must be lockable, with full, glass break type panels.

Installation Guidelines
The location and quantity of fire extinguisher cabinets must be in accordance with local building codes and as directed by the Fire Marshall. Cabinets and/or brackets must be plumb and level.

Quality Control
Provide fire extinguisher cabinets and accessories by a single manufacturer.

SECTION 10651

OPERABLE PANEL PARTITIONS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for operable partitions constructed o separate panels.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Summary
Manually operated, individual panel partitions.

Performance Requirements
Seismic Performance: Provide operable panel partitions capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:

Sound Transmission Requirements: Operable panel partition assembly tested in a full-scale opening, 14 by 9 feet, for laboratory sound transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.

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

Project Conditions
Field Measurements: Verify operable panel partition openings by field measurements before fabrication and indicate measurements on Shop Drawings.

SUBMITTALS

Product Data: For each type of product indicated.

Shop Drawings: Include plans, elevations, sections, details and attachments to other work.

For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

Indicate storage and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.

Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved.

Samples for Initial Selection: For each type of finish, covering, or facing indicated.

Fabric: Full width by not less than 36-inch-long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.

Panel Facing Material: Manufacturer's standard-size unit, not less than 3 inches square.

Panel Edge Material: Not less than 3 inches long.

Hardware: Manufacturer's standard exposed door-operating device.

Qualification Data: For Installer.

Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each operable panel partition.

Maintenance Data: For operable panel partitions to include in maintenance manuals.

PRODUCT STANDARDS

Products
Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- Hufcor: 5600R: single panel.
- KWIK-WALL Company: 2020 Series: single panels.

Operable Panels
Panel Construction: Provide top reinforcement as required to support panel from suspension components and provide reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

Dimensions: Fabricate operable panel partitions to form an assembled system of dimensions indicated and verified by field measurements.

Panel Width: Equal widths designed to fit into storage pocket

STC: Not less than 50 as tested under ASTM E 90 indicating 1/3-octave band transmission loss data from 125 Hz to 4000 Hz.

Panel Weight: 12 lb/sq. ft. maximum.

Panel Thickness: Not less than 3 inches.

Panel Closure: Manufacturer's standard.

Initial Closure: Flexible, resilient PVC, bulb-shaped acoustical seal.

Final Closure: Constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal.

Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

Seals
General: Provide types of acoustical seals indicated that produce operable panel partitions complying with acoustical performance requirements and the following:

Seals having the same or better seals as were used to meet the STC rating in lab testing.

Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.

Vertical Seals: Deep-nesting, interlocking astragals mounted on each edge of panel, with continuous PVC acoustical seal.

Horizontal Top Seals: Continuous-contact, extruded-PVC seal exerting uniform constant pressure on track when extended.

Horizontal Bottom Seals: PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.

Mechanically Operated: Extension and retraction of bottom seal by operating handle or built-in operating mechanism, with operating range not less than 1-1/2-inch between retracted seal and floor finish.

Finish Facing
General: Provide finish facings that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant non-staining adhesive as recommended by facing manufacturer's written instructions.

Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with invisible seams complying with Shop Drawings for location, and with no gaps or overlaps. Horizontal seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.

Color/Pattern: As selected by Architect from manufacturer's full range.

Vinyl-Coated Fabric Wall Covering: Manufacturer's standard mildew-resistant, washable, vinyl-coated fabric wall covering; complying with CFFA-W-101-B for type indicated; Class A.

Antimicrobial Treatment: Additives capable of inhibiting growth of bacteria, fungi, and yeasts.

Paint: Manufacturer's standard factory-painted finish.

Cap-Trimmed Edges: Protective perimeter-edge trim with tight hairline joints concealing edges of panel and finish facing, finished as follows:

Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper required to comply with performance requirements; and with manufacturer's standard color anodic finish.

Suspension Systems
Suspension Tracks: Steel or aluminum mounted directly to overhead structural support, designed for type of operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.

Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.

Multidirectional Carriers: Capable of negotiating 90-degree L intersections without track switches.

Track Intersections, Switches, and Accessories: As required for type of operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.

Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish, unless otherwise indicated.

Materials
- Steel Frame: Steel sheet, manufacturer's standard nominal specified thickness for uncoated steel.
- Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard thickness.
- Gypsum Board: ASTM C 36/C 36M.

INSTALLATION GUIDELINES

Execution
Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.

Floor flatness shall meet the minimum tolerances required by manufacturer to maintain STC ratings.

Proceed with installation only after unsatisfactory conditions have been corrected.

Installation
Verify that manufacturer's written instructions do not conflict with ASTM E 557.

Install operable panel partitions and accessories after other finishing operations, including painting, have been completed.

Install panels from marked packages in numbered sequence indicated on Shop Drawings.

Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

Cleaning and Adjusting
Adjust operable panel partitions to operate smoothly, without warping or binding. Lubricate hardware and other moving parts.

Clean soiled surfaces of operable panel partitions to remove dust, loose fibers, fingerprints, adhesives, and other foreign materials according to manufacturer's written instructions.

Warranty
Warranty Period: Five years from date of Substantial Completion.

Start-up and Training
Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

SECTION 10801

TOILET AND BATH ACCESSORIES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for toilet and bath accessories.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Toilet Accessories
- Specify toilet paper dispensers in the accessible stalls only, Brady Cormatic Vu-All liquid soap dispensers, inexpensive plastic toilet seat cover dispensers that take standard toilet seat covers, and feminine napkin disposals.
- (Scott #9550) in all stalls except the accessible stalls and the paper towel dispensers.
- Do not specify electric hand dryers or feminine napkin dispensers.

Product Standards
Products must conform to the following standards:
- ASTM A167: Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- Local accessibility codes
- UNLV accessibility guidelines

Equipment
Provide the following equipment for toilet rooms, bathrooms, locker rooms, and custodial closets. All dispensers must be surface mounted.

Toilet Rooms
Towel dispensers: one per every two lavatories, furnished by UNLV, and installed by the contractor

Waste dispensers
Toilet paper dispensers: double roll, one per stall, furnished by UNLV, and installed by the contractor

Sanitary napkin disposals: one per stall, surface mounted, Waxie or approved equivalent

Soap dispensers: one per lavatory, furnished by UNLV, and installed by the contractor

Grab bars: 1-1/2" diameter, quantity and arrangement as indicated in the contract documents and per local accessibility codes

Shelves: welded corners, one per toilet room

Mirrors: Refer to Section 08800 Glass and Glazing.

Bathrooms
- Toilet paper dispensers: double roll, one per stall, furnished by UNLV, and installed by the contractor
- Grab bars: l-1/2" diameter, quantity and arrangement as indicated in the contract documents and per local accessibility codes
- Shelves: one, with welded comers
- Mirrors
- Towel hooks: two per shower stall
- Soap dishes: one per shower stall

Locker Rooms
- Toilet paper dispensers: double roll, one per stall, furnished by UNLV, and installed by the contractor
- Grab bars: 1-1/2" diameter, quantity and arrangement as indicated in the contract documents and per local accessibility codes
- Shelves: one, with welded corners
- Mirrors
- Shower curtain rods: one per shower stall shower curtain and hooks: one per shower stall
- Sanitary napkin dispensers: one per women's shower room
- Sanitary napkin disposals: through partition type, one per every two stalls

Custodial Closets
- Custodian's utility units: two per closet
- Shelves: stainless steel, full width of closet

Manufacturers
Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to:
- Bobrick Washroom Equipment Inc.
- An approved equivalent.

Materials
Toilet and bath materials must be stainless steel, ASI No. 4, with a bright directional polish finish.

SECTION 11132

PROJECTION SCREENS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for ceiling mounted projection screens.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Summary
Electric ceiling mounted front projection screens.

QUALITY ASSURANCE

Measurement of Gain of Screen Viewing Surface: Measure gain of screen viewing surface against that of a magnesium carbonate surface by means of a photogoniometer using test methods and test apparatus per FS GG-S-00172D(1) for determining effect of reflected light at various viewing angles on screen surfaces.

Fire Performance Characteristics: Provide projection screen fabrics identical to those materials which have undergone testing and passed requirements for flame resistance as indicated below:

- NFPA 701 per small scale test.
- Federal Standard 191A/5903 for test method. FS GG-S-00172D(1) for flame resistance.
- Mildew Resistance: Provide mildew resistant screen fabrics as determined by Federal Standard 191A/5760.

SUBMITTALS

Product Data: Submit manufacturer's product data for each type of screen indicated.

Wiring Diagram: Submit manufacturer's wiring diagram for electrically operated units.

Installation: Submit frame/case fabrication details and mounting details specific to each screen installation.

Maintenance: Submit manufacturer’s maintenance and care instructions.

PRODUCT STANDARDS

Products
Provide manufacturer's standard UL-listed and -marked units consisting of case, screen, motor, controls, mounting accessories and other components as required for a complete installation and complying with requirements indicated for screen surface, controls and for case, motor and screen under description of operation and type.

Electric Ceiling Mounted Front Projection Screen (Type 1):

Screen Material:

- Comply with the following requirements for type of viewing surface:
- Completely seamless.
- Mildew- and flame-resistant vinyl-coated glass fiber or polyvinylfabric with viewing surface complying with requirements indicated.
- Viewing surface: Provide Ultramatte 130 screen surface, with a gain of 1.3 unless otherwise indicated.
- Provide Cinemaperf surface option including extra black drop.
- Each side of surface equipped with tab-guide cable system to maintain even lateral tension and hold surface flat. Bottom of surface supported and masked by black, extruded aluminum dowel weighted to apply proper vertical tension.
- Edge Treatment: Black masking borders, tab tensioned.

Image Size:

- Size of image as indicated on schedule.
- Provide extra black drop as required to locate screen at elevation shown on screen schedule.

Screen Controls:
Remote control operation of each screen as follows:

- Provide One 3-Position 24 Volt Control Switch.

Single Station Control: Low voltage control system for each screen consisting of a single control unit containing transformer for reducing 120 VAC electric power supply to 24 volts, pulse sequence relays, and multi button control stations of number and at locations indicated, with metal device boxes and cover plates for flush wall mounting.

Screen Motor:
Electrically operated 110-120V. AC, 60 Hz. 5-wire motor mounted inside screen roller, instantly reversible, lifetime lubricated with thermal overload protector and electric brake. Preset, accessible limit switches.

Screen Housing:
Units designed and fabricated for recessed or surface installation and complying with the following requirements:

Roller: Roller is to be at least 3” diameter metal, mounted on rubber insulated supports.

Screen Case: Case constructed of aluminum and fire-retardant hardboard. Case finished semigloss black.

Acceptable Product:

- Stewart Filmscreen Corp Model ABT.

Electric Ceiling Mounted Front Projection Screen (Type 2):

Screen Material:
Comply with the following requirements for type of viewing surface:

- Completely seamless.
- Viewing surface flame and mildew resistant fiberglass matt white, mounted to one-piece rigid steel roller.
- Bottom of viewing surface enclosed in dowel.
- Edge Treatment: Black masking borders.

Image Size:
Size of image as indicated on schedule.

Provide extra black drop as required to locate screen at elevation shown on screen schedule.

Screen Controls:
Remote control operation of each screen as follows:
- Provide One 3-Position 24 Volt Control Switch.

Single Station Control: Low voltage control system for each screen consisting of a single control unit containing transformer for reducing 120 VAC electric power supply to 24 volts, pulse sequence relays, and multi button control stations of number and at locations indicated, with metal device boxes and cover plates for flush wall mounting.

Screen Motor:
Electrically operated 110-120V. AC, 60 Hz. 3-wire motor mounted inside screen roller, instantly reversible, lifetime lubricated with thermal overload protector and electric brake. Preset, accessible limit switches.

Screen Housing:
Units designed and fabricated for recessed installation and complying with the following requirements:

Roller: Roller is to be 3” diameter metal, mounted on rubber insulated supports.

Screen Case: Extruded aluminum. Bottom panels form slot for passage of viewing surface, easily removable for access to motor and viewing surface. Provide case finish TBD by Architect.

Acceptable Product:
- Da-Lite Advantage Electrol w/ Single Motor Low Voltage Control System.

Screen Schedule: Provide Schedule with locations and sizes.

INSTALLATION GUIDELINES

General: Install projection screens at locations indicated in compliance with screen manufacturer's instructions.

Install ceiling mounted projection screens with screen cases in position and relationship to adjoining work indicated, securely anchored to supporting structure, and in manner which produces a smoothly operating screen with plumb and straight vertical edges and plumb and flat viewing surfaces when lowered. During screen travel, no objects shall impact or interfere with screen surface.

Test electrically-operated units to verify that screen, controls, limit switches, closure and other operating components are in optimum functioning condition.

Cleaning and Adjusting
Protect projection screens after installation from damage during construction. If despite such protection, damage occurs, remove and replace damaged components or entire unit as required to restore units to their original, undamaged condition.

SECTION 11150

PARKING CONTROL EQUIPMENT

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria and information for parking control equipment.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Summary
This Section includes the following:
- Automatic barrier gates.
- Vehicle detectors.
- Ticket dispensers.
- Exit terminals.
- Parking facility management software.

Quality Assurance
Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Extra Materials
Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Gate Arms: Two breakaway gate arms for each gate installed, complete with accessory components.

SUBMITTALS

Product Data: For each type of product indicated.

Shop Drawings: Include details of installation.

Operation and maintenance data.

PRODUCT STANDARDS

Products

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

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

- Amano Cincinnati, Inc.
- American Parking Equipment, Inc.
- Ascom Trindel Corporation.
- Automatic Control Systems, Inc.
- Delta Scientific Corporation.
- Operator Specialty Company, Inc.
- Automatic Barrier Gates

General: Provide UL-approved parking control device consisting of operator and controller housed in cabinet enclosure with gate arm. Device shall be activated by a signal from access or revenue control device. Fabricate unit with gate arm height in down position of not more than 35 inches (889 mm) to prevent even small vehicles from passing under gate arm.

Controller: Factory-sealed, solid-state, plug-in type, with galvanized steel box for wiring connections. Equip unit with the following features:

- Capable of storing successive inputs and sequentially processing each one.
- Automatic instant-reversing mechanism that stops downward motion of gate arm if arm strikes an object and that immediately returns arm to upward position. Include a 0- to 60-second variable-time reset device.

Cabinets: Fabricated from metal sheet with seams welded and ground smooth; approximately 15 inches square by 40 inches (381 mm square by 1016 mm) tall. Provide single, gasketed access door for each cabinet with flush-mounted locks. Furnish two keys for each lock[, all locks keyed alike]. Fabricate cabinet with internal reinforcing and four mounting holes accessible only from inside cabinet.

Straight Gate Arm: 1-by-4-inch nominal- Fiberglass, PVC, or polycarbonate, with painted finish and black diagonal stripes on traffic-side face. Provide mounting flange with breakaway feature to ensure clean break if arm is struck by vehicle.

Length: As indicated on Drawings.

Operator: 1/2 hp 60 Hz, single-phase, instant-reversing, continuous-duty motor for operating gate arm. Transmit power to gate-arm drive shaft through speed reducer to harmonic-acting crank and connecting rod. Fabricate crank, rod, and drive shaft of galvanized solid bar steel. Provide an operable cam for adjusting arm travel.

Vehicle Detectors
Vehicle Loop Detector System: Provide self-tuning electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit signal activating gate-arm operator. Include automatic closing timer with adjustable time delay before closing, timer cut-off switch, and vehicle loop detector designed to hold gate arm open until traffic clears. Provide number of loops consisting of multiple strands of wire, number of turns,

loop size, and method of placement at location shown on Drawings, as recommended in writing by detection system manufacturer for function indicated.

Field-Assembled Loop: Wire, in size indicated for field assembly, and sealant; style for saw-cut installation.

Vehicle Presence Detector: Provide emitter/receiver-type detector with adjustable detection zone pattern and sensitivity, designed to detect the presence or transit of vehicle in gate-arm pathway by interrupting infrared beam in zone pattern and to emit signal activating gate-arm operator. Include automatic closing timer with adjustable time delay before closing, timer cut-off switch, and vehicle presence detector designed to hold gate arm open until traffic clears.

Ticket Dispensers
General: Provide ticket dispenser units, consisting of ticket printing and issuing mechanisms, ticket magazines, and controllers housed in cabinet enclosures. Include the following features:
- Activation button with "Push for Ticket" message.
- Battery backup for clock and RAM memory.

Cabinets: Fabricated from metal sheet with seams welded and ground smooth, approximately 15 inches square by 40 inches (381 mm square by 1016 mm) tall; consisting of base and top components. Provide single, gasketed access door for each base component with flush-mounted locks. Furnish two keys for each lock[, all locks keyed alike]. Fabricate cabinet with internal reinforcing and four mounting holes accessible only from inside cabinet. Fabricate top component so it can be unlocked and opened for ticket loading and maintenance. Include flush-mounted lock in rear of top, keyed the same as base component lock.

Units shall be activated by push-button operation. On activation, unit automatically records entry time and date on ticket, sounds buzzer, and dispenses ticket.

Exit Terminals
General: Provide exit terminals consisting of magnetic-stripe ticket readers, LCD displays, and dot-matrix or thermal printers housed in metal cabinet. Provide "Please Insert Ticket" sign on side of cabinet visible to driver. Include the following features:

Operation: On-line communication to remote computer.

System Performance: Capable of being activated by vehicle loop detector; programming grace period, display, and timer; and producing reports.

Cabinets: Fabricated from metal sheet with seams welded and ground smooth; approximately 15 inches square by 40 inches (381 mm square by 1016 mm) tall. Provide single, gasketed access door for each cabinet with flush-mounted locks. Furnish two keys for each lock[, all locks keyed alike]. Fabricate cabinet with internal reinforcing and four mounting holes accessible only from inside cabinet.

Parking Facility Management Software
General: Manufacturer's standard software that is compatible with security access control system and that provides automatic facility monitoring, supervision, and remote control of parking control equipment from one or more locations.

System Performance: Capable of collecting data for revenue and activity reporting and for access and space control, and capable of tracking tickets and programming parking control equipment.

INSTALLATION GUIDELINES

Examine roughing-in for electrical systems to verify actual locations of connections before parking control equipment installation.

Automatic Barrier Gates: Anchor cabinets to concrete bases with anchor bolts or expansion anchors and mount barrier-gate arms.

Vehicle Loop Detectors: Cut grooves in pavement and bury and seal wire loop at locations indicated on Drawings. Connect to parking control equipment operated by detector.

Connect equipment to remote computer.

Adjust parking control equipment to operate smoothly, easily, and properly. Confirm that locks engage accurately and securely without forcing or binding.

Remove barrier-gate arms during the construction period to prevent damage, and install them immediately before Substantial Completion.

QUALITY CONTROL

Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

Operational Test: After electrical circuitry has been energized, units shall be started to confirm proper motor rotation and unit operation.

Controls and safeties shall be tested and adjusted. Report any damaged and malfunctioning controls and equipment.

Remove and replace parking control equipment where test results indicate that it does not comply with specified requirements.

Start-up and Training
Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain parking control equipment.

SECTION 11600

FUME HOOD

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

The Department of Risk Management & Safety (RMS) has adopted the following guidelines for the design, installation, renovation, maintenance, and dismantling of chemical fume hoods on the UNLV campus and UNLV affiliated facilities.

These guidelines reflect federal, state, local, and University health and safety regulations and policies. The guidelines do not stand alone, but must be incorporated with other applicable standards into the design and construction of a fume hood. Regulations and technology are constantly changing and these guidelines may not reflect current best practices and regulatory requirements; therefore RMS shall be consulted whenever new fume hoods are to be installed or when existing hoods need to be modified or replaced. In this way, those who use and maintain chemical fume hoods will be ensured of an adequate level of protection from the possible harmful effects of laboratory chemicals.

A laboratory fume hood is a ventilated enclosure where hazardous materials can be handled safely. The purpose of the hood is to contain contaminants and prevent their escape into the laboratory. This is accomplished by drawing (by air flow) contaminants within the hood’s work area away from the user thereby preventing and minimizing inhalation and contact with hazardous materials.

To create airflow into the hood, an exhaust blower “pulls” air from the laboratory room into and through the hood and exhaust system. A baffle, airfoil, and other aerodynamically designed components control the patterns of air moving into and through the hood.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

- References
- Air Movement and Control Association, Inc (AMCA)
- American Conference of Governmental Industrial Hygienists (ACGIH), Industrial Ventilation Manual, Latest Adopted Edition
- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRE), Fundamental Handbook
- American Society of Testing Materials (ASTM) E 162
- National Fire Protection Association (NFPA), Exhaust Systems for Air Conveying of Materials, NFPA 91- Latest Adopted Edition
- National Fire Protection Association (NFPA), Fire Protection for Laboratories Using Chemicals, NFPA 45-Latest Adopted Edition
- Occupational Safety and Health Administration, Occupational Exposures to Hazardous Chemicals in Laboratories, 29CFR 1910.1450

QUALITY CONTROL TESTING

During routine servicing and repair or dismantling of a laboratory fume hood the potential exists for exposure to hazardous substances that had been used or stored in the hood. To guard against this, certain protective measures, appropriate to the specific situation, should be implemented before work begins.

Fume Hood Evaluation in the Field: Evaluation of new or refurbished laboratory fume hoods shall be performed by the installer prior to releasing the fume hoods for use. Tests shall be performed by qualified personnel to verify proper operation of the fume hoods.

Average face velocities shall be checked by RMS every six (6) months.

Verify that the building make-up air system is in operation, the doors and windows are in normal operating position, and that all other hoods and exhaust devices are operating at design conditions.

Check room conditions in front of the fume hood using a thermal anemometer and a smoke source to verify that the velocity of cross drafts does not exceed 20 percent of specified average fume face velocity. Any cross drafts that exceed these values shall be eliminated before proceeding with the fume hood test.

With the sash open 18 inches, measure the face velocity at nine different points across the fume hood face. Readings should be taken at equal distances across the face of the hood. Average air velocity at the hood face must be 80 linear feet per minute (fpm) with a minimum of 60 fpm at any measured point.

Fume hoods with acceptable face velocities shall be labeled and signed off by the RMS representative.

Deficient fume hoods shall be labeled with appropriate signage (See Caution Notice, Forms Section). The principal investigator will be informed that the fume hood is deficient and should not be utilized pending repair by Facilities Management.

Fume hoods with inadequate face velocities will be reported to Facilities Management for repair. Facilities Management personnel shall follow the procedures listed in the Servicing and Dismantling Section of this policy.

Upon completion of the repair work, Facilities Management will notify RMS. RMS will then evaluate the face velocity of the hood to assure optimum conditions are being met. A label will then be placed in the hood indicating that the hood is certified for use.

Procedures Prior to Servicing or Dismantling
Laboratory personnel must:

- Remove all equipment in the hood that may impede or impair access.
- Remove all chemicals and radioactive materials in the hood that may pose a hazard.
- If necessary, decontaminate the interior of the hood as appropriate.
- If necessary, don protective clothing (i.e. goggles, respirator, coveralls, gloves, arm guards).

If the fume hood needs to be turned off, notify laboratory workers and post a Caution Notice on the hood. A designated person from the laboratory is responsible for ensuring that the procedures mentioned above have been done. Upon completion of the necessary decontamination procedures, the responsible party must fill out the appropriate form and attach it to the front of the fume hood.

Fume Hood Service Procedures
The following procedures are to be followed by anyone who must service any part of a fume hood system at UNLV. (Service includes mechanical work, sheet metal work, painting and electrical work.)

Locate on the roof the fume hood blower or motor to be serviced and the room in which it is housed.

Communicate to lab personnel the need to service the fan or hood and obtain permission to shut down the hood. If lab personnel are not available, contact the department office to obtain permission to shut down the hood. DO NOT TURN OFF WITHOUT PERMISSION FROM AN AUTHORIZED PERSON.

Fill out a Caution Notice and fix it to the hood sash (copy attached, Forms Section). Then shut down the fan. Note: Information on the tag should include:

- Date of shut down
- Expected duration of shut down
- Reason for shut down
- Your name
- Your supervisors phone number
- After service is completed, restart the fan and remove the notice from the fume hood(s).

INSTALLATION GUIDELINES

Listed below are the guidelines to be followed as part of the fume hood construction, installation, or renovation process. These guidelines are divided into nine categories: Laboratory Design, Fume Hood Construction and Installation, Ductwork, Exhaust Fan, Exhaust Stack, Plumbing, Electrical, Utility Service Fixtures, and Sashes.

Laboratory Design
Fume Hoods must be located away from heavy traffic aisles and doorways so that persons exiting the lab do not have to pass in front of the fume hood. The potentially dangerous portion of an experiment is usually conducted in a fume hood. Many lab fires and explosions originate in fume hood and a fume hood located adjacent to a path of egress could trap someone in the lab.

There must be two exits from rooms where new fume hoods are to be installed. If this is not feasible, the fume hood must be situated on the side of the room furthest from the door. A fire or chemical hazard, both of which often start in a fume hood, can render an exit impassible. For this reason, all labs with fume hoods are required to maintain two unblocked routes of egress.

Fume hoods must not be situated directly opposite occupied work stations. Materials splattered or forced out of a hood could injure anyone seated across from it.

Fume hoods should be so located within the laboratory to avoid cross currents at the fume hood face due to heating cooling, or ventilation supply or exhaust diffusers. Cross currents outside a hood can nullify or divert air flow onto a hood, negatively affecting its capture ability.

Sufficient make-up air must be available within the laboratory to permit fume hoods to operate at their specified face velocities. A fume hood exhausts a substantial amount of air. Therefore, additional make-up air must be brought into the room to maintain a proper air balance.

Windows in labs that have fume hoods must be fixed closed. Breezes coming in through open lab windows can adversely affect the proper functioning of the hood. Turbulence caused by these wind currents can easily bring the contaminated air inside the hood back into the laboratory.

Safety devices such as deluge showers, eye wash stations, fire extinguishers, and fire blankets should be located convenient to the fume hood operating personnel.

Fume hoods shall not have an on/off control accessible in the laboratory, unless the lab has an alternate exhaust ventilation system or the exhaust is being filtered through a charcoal or HEPA filter. Fume hoods are an integral part of the entire laboratory's air balancing system which must be maintained.

Labs must be maintained under positive pressure. And when a fume hood is turned off, the lab must maintain positive pressure.

Fume Hood Construction and Installation

Supply or auxiliary air hoods are unacceptable for new fume hoods installations. It is very difficult to keep air supply and exhaust of supply hoods properly balanced. In addition, the supply air is intemperate, causing discomfort for those working in the hot or cold air stream.

Constant volume bypass fume hoods are recommended. These hoods permit a stable air balance between the lab's ventilation system and the fume hoods exhaust by incorporating an internal bypass feature. This allows a constant volume of air to be exhausted through the hood regardless of sash position. Variable volume systems may be acceptable if properly designed.

Portable, non-ducted fume hoods are not allowed except for limited uses as approved by RMS. Non-ducted fume hoods utilize filters which may be overwhelmed in the event of a spill. Breakthrough can also occur as the contaminant is dislodged with the sudden changes in air flow velocity associated with turning the blower on and off. In addition, an adequate level of protection cannot be assured for different classes of chemicals.

Interior fume hood surface should be constructed of durable, corrosion-resistant, non-porous, non-combustible, fire-resistant materials such as stainless steel or special composite or polymer material. Corrosive materials can damage many types of materials, shortening fume hood life. In addition, some materials, when exposed to direct flame, emit noxious and toxic fumes.

The work surface inside the fume hood must be of the recessed type. With a recessed type work surface, spills can be effectively contained by the retaining lip.

Plastic or fiberglass hoods are unacceptable. Although some plastic and fiberglass containing construction materials may be non-combustible; when involved in a fire they generate large quantities of dense, potentially toxic smoke. This smoke presents a hazard to both building occupants and fire fighters.

An airflow indicator must be provided at the fume hood.

Hood shall operate at an acceptable sound level so that it does not pose a hearing loss hazard or be an annoyance.

There should be a horizontal bottom airfoil inlet at the front of the hood. The airflow at the front of the hood assures a good sweep of air across the floor toward the back of the hood. This minimizes the generation of turbulent eddy currents at the entrance to the hood.

A baffle with adjustable horizontal slots should be present at the back and top of the fume hood interior. Baffles assist in maintaining a unidirectional airflow.

Baffles should be at adjusted in such a way that less than a +10 variation in face velocity measured with the sash in its maximum open position can be obtained.

Average air velocity at the hood face must be at least 80 linear feet per minute (fpm), with a minimum of 60 fpm at any measured point. If regulated carcinogens are to be used, an average air velocity of 100 fpm should be maintained with a minimum of 80 fpm at any measured point.

Where feasible, chemical fume hoods should be capable of switching to emergency power in case of a power failure.

Ductwork

If gang ducting of fume hoods is necessary, the system must be properly designed with final approval from RMS and Facilities Management.

Perchloric and radioactive material hoods shall have individual exhaust systems.

Design criteria for fume hood duct construction include:
- Minimum 18 gauge, Type 316 stainless steel. Coated galvanized steel may be considered under circumstances.
- Heliarc inert gas with Type 316 welded seams

Follow the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Round Industrial Duct Construction Standards for duct supports and reinforcement using stainless steel material.

Follow SMACNA 2000 HVAC Duct Construction Standards using type 316 stainless steel for exhaust stack on roof.

Fire control-type dampers should not be utilized in fume hood exhaust systems.

Duct velocities should maintained between 1600-2000 linear feet per minute (fpm) to minimize noise, static pressure loss, and blower power consumption within a duct system.

Slope all horizontal ducts down towards the fume hood (Guideline: 1/8" to the foot). Liquid pools, which result from condensation, can create a hazardous condition if allowed to collect.

New duct installation should be tested at negative pressure, 11/2 times its operating pressure. Tests should show zero leakage.

Exhaust Blower and Stack
New exhaust blowers should be oriented in an up-blast orientation. Any other type of fan orientation increases the work load required from the fan.

The exhaust blower should be located at the roof of the point of final discharge to provide a negative pressure in that portion of the duct system located within the building.

Hood exhausts in the roof should be located away from air intakes to prevent re-entrainment of exhaust fumes.

Fume hood exhaust stacks shall be of adequate height (at least seven feet above the roof or at two feet above the top of a parapet wall, whichever is greater) to prevent or minimize re-entry of contaminants or to comply with air pollution regulations. Discharge must be directed vertically upward.

Discharge from exhaust stacks should have a velocity of at least 3,000 fpm. A sufficient discharge velocity is necessary to adequately disperse contaminants. Provide air cleaning on exhaust as needed.

Exhaust stacks shall be color-coded as follows:
- Green: Regular Chemical Hood
- Yellow: Perchloric Acid Hood
- Magenta: Radiological Hood
- Blue: Biosafety Hood

Plumbing
All Plumbing utilities must have a shut-off valve or cock adjacent to the hood.

If remote control fittings are used for hood utilities, the extension rod shall be solid four-sided stainless steel with a Monel coupling and set screw.

Hot or cold water supplies must be connected to non-potable industrial water system. If industrial water is not available in the building, then a reduced pressure type back flow device shall be used on each water system. A single device may serve several hoods.

Electrical

Electrical outlets must be outside the hood. The atmosphere inside a fume hood may contain flammable gases or vapors that can ignite, resulting in a fire or explosion. For this reason, any activity - including plugging into and unplugging from an electrical outlet - which may produce a spark, must be performed outside the hood.

Lighting fixtures should be of the fluorescent type. Fluorescent bulbs give off less heat than conventional bulbs. They help maintain a safe and comfortable work area inside the hood.

Light fixtures should be sealed and vapor tight, UL-listed and protected by a transparent impact resistant shield. The potential for flammable or combustible atmospheres requires explosion-proof electrical equipment.

Utility Service Fixtures

Utility service include connections to gases, air, water, and vacuum.

Should be installed to allow the connection of service supply lines either on the hood itself or the work surface supporting the hood.

Service valves shall be accessible for maintenance.

Service valves shall be corrosion-resistant if located inside the hood.

All service fixtures controls shall be controlled from the outside of the hood.

All service fixture controls shall be color-coded and shall be clearly identified.

Sashes

Sashes may either be horizontal, vertical, or a combination, and should have the capability to completely close off the hood face.

Sashes should be made of safety glass:

Laminated safety glass for standard use when internal temperature is anticipated to be less then 1600 F.

Tempered safety glass when high internal temperatures are anticipated that will result in sash surface temperatures greater that 1600°F. Where hydrofluoric acid is used, sashes will be made of plastic or lexan with a flammability rating of 25 or less when tested in accordance with ASTM E162-76

Horizontally sliding sash panels may not be less than twelve inches, nor more than fifteen inches in width. Such sashes may offer extra protection to lab workers as they can be positioned to act as a blast shield.

Special Use

Perchloric Acid - Perchloric acid is a strong oxidizer which, in contact with organic materials, can form an explosive reaction product. For this reason, special construction materials are required for laboratory fume hoods in which substantial quantities of perchloric acid are frequently used. For additional information or consultation contact RMS at extension 54226.

Laboratory fume hoods designated for use with perchloric acid shall be identified by a label indicating suitability for use with perchloric acid procedures.

All exposed hood and duct construction materials shall be suitable for use with perchloric acid - inorganic, non-reactive, acid resistant and relatively impervious.

The work surface in the hood shall be water tight and dished or furnished with a raised bar to contain spills and washdown water.

The fume hood and exhaust ducting design shall be provided with a water spray (washdown) system. The baffle must be removable to allow for periodic cleaning and inspection.

Each perchloric acid fume hood must have an individually designated duct and exhaust system. The duct system should be straight, vertical and as short as possible.

Use only an acid resistant metallic fan.

Do not use lubricants, caulking materials, gaskets or other materials in the fan that are not compatible with perchloric acid. Use fluorocarbon type grease.

The fan motor must be located outside of the airstream.

Radiological Fume Hoods
Facilities Maintenance personnel shall contact the person responsible for the lab to schedule service, and shall NOT enter a laboratory or area restricted for purposes of radiation safety unless accompanied by the Authorized User or Radiological Safety Office personnel. Written Radiological Safety Officer (RSO) approval shall be posted on the hood by the user prior to servicing.

All radiological hoods shall vent separately to the outside of the building.

The RSO shall provide a list of fume hoods used for radiological materials.

Maintenance personnel are to receive basic radiation safety instruction from the Radiological Safety Officer prior to work in active laboratories.

The RSO shall monitor fume hoods at the request of the authorized user or Facilities Maintenance personnel PRIOR to scheduled repair or maintenance, and provide written approval to be posted on the hood.

The authorized user of radioactive materials shall control radioactive materials used in hoods as follows:

Radioactive materials shall be secured against unauthorized removal, and all surfaces decontaminated and surveyed to assure that no contamination remains when unattended. This is to assure that no radiation hazard is present during routine, non- scheduled maintenance activities.

If radioactive materials are unattended for any reason without direct supervision by the user or trained assistants, the room shall be locked to prevent unauthorized entry.

The authorized user or his assistants shall promptly notify the RSO of any spill, accident, or any operation which may have contaminated the hood or released any contamination.

The user shall provide documentation of his or her radiation and contamination surveys of the hood to the RSO. The user may directly supervise work without RSO approval, and then assumes responsibility for radiation safety.

All radiological fume hoods and exhaust blowers shall be labeled: “CAUTION Radioactive Material” and exhaust stacks shall be striped magenta.

Iodination Mini Hoods
The Radiation Safety Officer shall be contacted before an iodination mini hood is installed.

Iodination mini hoods must be located within an already operative laboratory fume hood. Each mini hood must be equipped with a charcoal filter.

The mini hood should be compatible with the laboratory fume hood with respect to size and airflow.

Air flow through the arm portals should be maintained at 150 linear feet per minute.

Plexiglas construction is recommended.

SECTION 12360

LABORATORY CASEWORK

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for laboratory casework, countertops, sinks and service fixtures.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Casework must be manufactured, delivered, and installed under the direct supervision of a single manufacturer to ensure a single source of responsibility.

Depending on lab use, select lab casework material on a case-by-case basis.

Submittals
Contractors must submit the following design and construction documents to UNLV.

Product Data
Provide product data for appliances and equipment, cabinet hardware, sinks, and tailpieces.

Shop Drawings
Indicate component dimensions, configurations, elevations, construction details, joint details, and attachments.

Samples
- Submit samples of casework finish designating the finish and color.
- Submit samples of countertop materials.

Test Reports
Submit product test data. The following product performance tests must be performed and certified by an independent testing agency:
- Base cabinet construction: racking test
- Wall cabinet construction: racking test
- Wall cabinet construction: static load test
- Drawer comer or joinery strength test
- Drawer construction: static load test
- Cabinet adjustable shelf and support devices: static load test
- Cabinet interior, exterior, and edging materials: acid resistance tests

Warranty
Provide a five-year manufacturer's warranty covering all casework furnished.

PRODUCT STANDARDS

All casework must conform to Scientific Equipment and Furniture Association publication SEFA 8-1998: Performance and Recommended Practices.

Table 1 is a guide for selecting laboratory countertop materials. Select countertop materials based on the use of the laboratories and an evaluation of the chemicals.

Table 1. Laboratory Countertop Materials

Countertop Material	Life Expectancy	Type of Use
Plastic laminate	20	Offices, electronics lab, dry activities
Chemical-resistant plastic laminate	20	Clinical labs
Solid surfacing (Corian), Group C Sink bowl	50	Clinical labs, some chemical labs
Phenolic resin composite	50	Chemical labs
Epoxy resin - black, 1" thick Sink bowl	50	Chemical labs
Epoxy resin - gray, 1" thick	50	Chemical labs
Epoxy resin - white, 1" thick, factory quote only	50	Chemical labs
Stainless steel, type 302/304 Sink bowl	Life	Wet Labs with frequent cleaning and high durability

Cost per lineal foot assumes that the counter top is 25" deep with 4" high square backsplash (except coved at stainless steel).

Cost per lineal foot includes installation.

Sink installation and connections by others.

Manufacturers
Subject to compliance with the design requirements, provide products by Fisher-Hamilton or Kewaunee.

Materials
Use the following laboratory casework materials.

Steel
- ASTM A366, mild steel, cold-rolled, pickled, double annealed patent leveled
- Free from rust, scales, scratches, buckles and other defects
- Steel sheets must be metallic furniture stock
- Electro-statically applied urethane powder coat finish

Stainless Steel
- ASTM A240, Type 304 stainless steel for tops, sinks, shelves, and casework
- #4 satin finish
- Epoxy Resin Bench Tops
- Molded, modified epoxy resin sheets
- Uniform mixture throughout
- Not depending on a surface coating that can be readily removed by chemical abuse

Glass
1/4" thick clear, laminated, safety glass for framed and unframed cabinet doors

Solid Surface Countertops
Corian by DuPont or an approved equivalent

Plastic Laminate and Chemically-Resistant Plastic Laminate
Nevamar, Formica, or an approved equivalent

INSTALLATION GUIDELINES

The top, bottom, sides and doors of flammable liquid storage cabinets must be not less than 18-gauge, double-walled steel construction, with 1-1/2" between the walls. Cabinet doors must be equipped with a three-point latch system. Provide a liquid-tight pan that can hold 2"of liquid. Cabinets must be ventilated, with flame arrestors provided on all vents. Cabinet fronts must be clearly labeled "FLAMMABLE-KEEP FIRE AWAY" with 1" high letters.

Corrosive chemical storage cabinets must be constructed from a complete corrosion-resistant liner. Cabinets must be ventilated. Provide a liquid-tight pan that can hold 2"of liquid. Cabinet fronts must be clearly labeled "ACID STORAGE" with 1" high letters.

SECTION 12484

FLOOR MATS AND FRAMES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for recessed floor mats and grilles.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Summary

- Recessed floor mats shall be provided at each building entrance.
- Entry mats shall be recessed aluminum tread rail hinged floor mats, or carpet-type mat
- Frames shall be aluminum, bronze or another material which complements the building design and is approved by the Owner.

Quality Assurance
Accessibility Requirements: Comply with "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and requirements of authorities having jurisdiction.

SUBMITTALS

Product Data: For each product indicated.

Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

Verify recesses and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings.

Samples: 12-inch- (300-mm-) square assembled sections of floor mats, frame members, and tread rails with selected tread surface showing each type of metal finish and color of exposed floor mats, tread rails, frames, and accessories required.

PRODUCT STANDARDS

Roll-up Aluminum Rail Hinged Mats: Extruded-aluminum tread rails sitting on continuous vinyl cushions.

Aluminum Finish: To be determined to match building

Treads: As selected for specific project: Plain serrated aluminum; Textured-surface, resilient vinyl inserts; Ribbed-design-surface, resilient vinyl inserts; Mineral abrasive particles bonded to or embedded in vinyl inserts; or Aluminum oxide or silicon-carbide grit abrasive fill in epoxy matrix inserts.

Carpet-Type Mats: Carpet bonded to 1/8- to 1/4-inch- (3- to 6-mm-) thick, flexible vinyl backing to form mats 3/8 or 7/16 inch (9.5 or 11 mm) thick with nonraveling edges.

- Carpet Material: Nylon.
- Tapered Flexible Molding: Tapered vinyl carpet edge moldings with flanges fused to back of mat at all four edges, with mitered corners.
- Recessed Aluminum Frames: Extruded aluminum, ASTM B 221 (ASTM B 221M), alloy 6061-T6 or alloy 6063-T5, T6, or T52.
- Finish: As appropriate to building design.

MANUFACTURERS

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

- AFCO-USA.
- Arden Architectural Specialties, Inc.
- Balco, Inc.
- Construction Specialties, Inc.
- Musson, R. C. Rubber Co. (The).
- Pawling Corporation.

INSTALLATON GUIDELINES

Fabrication
Floor Mats: Shop fabricate units to the greatest extent possible.

If not otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning.

Where joints in mats are necessary, space symmetrically and away from normal traffic lanes.

Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.

Recessed Metal Mat Frames: Size and style to fit floor mat type specified, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.

Corrosion Protection: Coat surfaces of aluminum frames that will contact cementitious material with manufacturer's standard protective coating.

Installation
Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.

For installation in terrazzo flooring areas, provide allowance for grinding and polishing of terrazzo without grinding surface of recessed frames. Coordinate with other trades as required.

Install surface-type units coordinated with entrance locations and traffic patterns.

Anchor fixed surface-type frame members to floor with devices spaced as recommended by manufacturer.

Protection: After completing frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses and cover frames with plywood protective flooring. Maintain until Substantial Completion.

SECTION 12492

VERTICAL LOUVER BLINDS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for vertical louver blinds.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Summary
Vertical louver blinds with PVC vanes.

Quality Assurance
Vertical Louver Blinds Fire-Test-Response Characteristics: Provide products passing flame-resistance testing according to NFPA 701.

SUBMITTALS

Product Data: For each type of product indicated.

Shop Drawings: Include plans, elevations, sections, details, details of installation, operational clearances, and relationship to adjoining Work.

Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

Samples: For each exposed finish and for each color and texture required.

Window Treatment Schedule: Use same room designations indicated on Drawings.

PRODUCT STANDARDS

Finish:
Louver Vanes: Colors, textures, patterns, and glosses selected from manufacturer's full range.

Rail: Manufacturer's standard baked-on, color-coated finish in colors as selected from manufacturer's full range.

Valance: Color, texturs, pattern, and gloss matching louver vanes, as selected from manufacturer's full range

Rail System: Headrail, Dual system with head and bottom rails may be considered for special locations.

Rails: Extruded aluminum; long edges returned or rolled; channel-shaped, enclosing operating mechanisms.

Louver Vanes: Lead-free, UV-stabilized, integrally colored, opaque, permanently flexible, extruded PVC that will not crack or yellow; and not less than 3/8-inch (9.5-mm) overlap when vanes are rotated fully closed.

Profile: Flat, in 3 inches minimum width. Perforated vanes are acceptable.

Vane Directional Control: Manual with nickel-plated metal bead chain.

Traversing Control: Manual with nickel-plated metal bead chain.

Mounting: As indicated on drawings and permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated.

Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind.

MANUFACTURERS

Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- Hunter Douglas Window Fashions
- Levolor Contract, a Newell Company, LouverDrape
- Springs Window Fashions Division, Inc., Graber

INSTALLATION GUIDELINES

Install blinds level and plumb and aligned with adjacent units per manufacturer's written instructions. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware, if any.

Coordinate requirements for distance between blinds and glass with clearances between blind perimeter and surrounding construction, tilt limits, glass type, and placement of heating/cooling air supplies to avoid heat build-up and possible damage to glass. Generally retain option for 2 inches (50 mm) in subparagraph below. See Evaluations and GANA's "Glazing Manual."

Preferred Installation: Flush Mounted: Install blinds with louver edges flush with finish face of opening when vanes are tilted open.

Adjusting: Adjust vertical louver blinds to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

Cleaning: Clean vertical louver blind surfaces after installation, according to manufacturer's written instructions.

SECTION 12610

FIXED AUDIENCE SEATING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for fixed audience seating.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Summary
Fixed audience seating with the following:

- Self-rising seat mechanism.
- Pedestal mounting.
- Molded-plastic with upholstered-insert chairs.

Quality Assurance
Installer Qualifications: An experienced installer who has specialized in installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

Fire-Test-Response Characteristics of Upholstered Chairs: As Follows:
Padding: Comply with California Technical Bulletin 117

- Source Limitations: Obtain each type of seating required, including accessories and mounting components, through one source from a single manufacturer.
- Upholstery Fabric: Obtain fabric of a single dye lot for each color and pattern of fabric required.
- Electrical Components, Devices, and Accessories: Listen and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdictions, and marked for intended use.
- Mockups: Before installing seating, install mockups for each type of seating required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

Install mockups to comply with the following requirements, using materials indicated for the completed Work:

- Install mockups in the locations and of the size indicated or, if not indicated, as directed by Architect.
- Notify Architect seven days in advance of dates and times when mockups will be constructed.
- Obtain Architect's approval of mockups before starting installation.
- Maintain mockups during installation in an undisturbed condition as a standard for judging the completed Work.
- Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

- Reinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

SUBMITTALS

Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

Upholstery Fabric: Full-width Sample, not less than 36 inches long, with fabric treatments applied. Show complete pattern repeat. Mark top and right side.

Molded Plastic: Manufacturer's standard-size unit, not less than 3 inches square.

Plastic Laminate: Manufacturer's standard-size unit, not less than 3 inches square.

Baked-on Coating Finishes: Manufacturer's standard-size unit, not less than 3 inches square.

Aluminum Finishes: Manufacturer's standard-size unit, not less than 3 inches square.

Wood and Plywood Materials and Finishes: Manufacturer's standard-size unit, not less than 3 inches square.

Row-Letter and Chair-Number Plates: Full-size units with letters and numbers marked.

Exposed Fasteners: Full-size units of each type.

PRODUCT STANDARDS

Basis-of-Design:
Manufacturer: Irwin Seating Company "Millennium"

Materials and Finishes
Fabric: Manufacturer's standard 100 percent nylon or 100 percent olefin.

Weight: 18 oz./linear yd..

Color and Pattern: As selected by Architect.

Chair Mounting: As follows:
- Floor attached.

MATERIALS

Extra Materials
Furnish extra materials described below, before installation begins, that are from the same production run and match products describing contents. Deliver extra materials to Owner.

Chair Seats and Backs: Furnish a quantity of full-size units equal to 5 percent of the amount installed for each type and size of chair seat and back.

Upholstered, Slip-on Cushions: Furnish a quantity of full-size units equal to 5 percent of the amount installed for each type and size of cushion.

Tablet Arms: furnish a quantity of full-size units equal to 5 percent of the amount installed for each type of armrest.

Armrest: Furnish a quantity of full-size units equal to 5 percent of the amount installed for each type of armrest.

SPECIAL REQUIREMENTS

Environmental Limitations: Do not install seating until space is enclosed and weather proof; wet work in space is complete and dry; finishes, including painting, are complete; and work above ceilings is complete. Do not install seating until ambient temperature and humidity conditions are continuously maintained at the levels anticipated for final occupancy.

INSTALLATION GUIDELINES

Fabrication
Upholstery: Fabricate fabric-covered items with molded padding beneath fabric and with fabric covering free of welts, creases, stretch lines, and wrinkles. For each upholstered component, install pile and pattern run in a consistent direction.

Upholstered Chairs: As follows:

- Backs: Backs shall be padded and upholstered on their face with a one-piece injection molded polypropylene rear panel, and shall extend to a nominal 32 ½" above finished floor. The top perimeter shall be shaped to be level across the top and blend at the sides with the vertical edges of the back. The face of the back shall be upholstered over a (2") thick polyurethane foam pad. The outer panel shall be injection molded polypropylene plastic, high impact resistant, with textured outer surface, formed to enclose the top of the inner upholstery panel. Rear, outer panels should not be less than 28 ½" in length, extending below the seat level to protect the seat cushion. There shall be no exposed screws above the armrests. Back wings for attaching the backs to the standards shall not be less than 14 gauge steel, and shall be secured to the inner panel by through-bolting via four (4) machine screws and threaded steel washers. Back wings shall provide for 18 degree, 22 degree, or 26 degree pitch of back.
- Seats: Seats shall be Loge style, upholstered on their face with serpentine spring cushions supported by a structural, injections molded polypropylene foundation, and shall be quietly and automatically self-lifting to a ¾ fold position when unoccupied. The seat cushion shall be 4 ½: high at the front, and have a base structure of five serpentine springs spanning a structural, injection molded, glass filled polypropylene frame. Height of the cushion at the front edge shall be consistent at 4 ½" above the foundations. The seat cushion assembly shall be securely locked to the front seat foundation, preventing unauthorized removal; but facilitating convenient removal by trained maintenance personnel. Seat foundation shall be 25% glass-filled, injection molded polypropylene, strengthened by deep internal ribs and gussets, completely enclosing the self-lifting mechanism. Bolted attachment of the seat component to the chair structure shall be concealed be a color-coordinated plastic cap. The

seat shall rotate on two, molded, structural glass-filled nylon hinge rods in internally molded channels with integral downstops for strength. Seat-lift shall be accomplished by compression springs and lubricated plastic cams.

- Chair Seat hinges: Self-lubricating, compensating type with noiseless self-rising seat mechanism passing ASTM F 851 and with positive internal stops cushioned with rubber or neoprene.
- Chair Back Hinges: Self-lubricating type with noiseless mechanism that raises back to vertical position when chair is unoccupied.
- Armrests: Fabricated for concealed mounting and with rounded edges.
- Foldaway Tablet Arms: With cast-iron or steel hinge and swivel mechanism that gives positive support in open position and semiautomatic return to stored position below arm block and parallel to chair.

Installation

Install seating with chair ends aligned from first to last row and with backs and seats varied in width to optimize sightlines.

SECTION 13100

LIGHTNING PROTECTION

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for lightning protection.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Summary
Lightning protection systems shall be designed by a qualified engineer. If not the project's electrical engineer of record, the lightning engineer shall coordinate with the electrical engineer.

Lightning protection systems shall be tailored for the specific environmental requirements of the project.

The following items of work are specifically included in, but not necessarily limited to, the work of this section without limiting the generality implied by these specifications:

- ESE (Early Streamer Emission) lightning protection air terminal
- Mast, complete with base and supports
- Down conductors
- Grounds
- Transient Voltage Surge Suppression

Description of System
The ESE installer shall provide a complete installation of equipment to comprise a complete system in accordance with Manufacturer's Recommendations.

The ESE installer shall be responsible for all components and labor to accomplish this result.

The system, including the ESE air terminal, conductors, mast and complementary parts, shall be installed so that completed work is unobtrusive and does not detract from the building appearance.

The ground resistance of the completed system shall be measured using IEEE "Fall of Potential Method" in the presence of the Architect/Engineer and shall be forwarded to the ESE manufacturer.

Ground resistance shall be ten (10) ohms or less.

Codes, Regulations, Permits
The completed system shall comply with all local codes and applicable governing authorities as well as the ESE manufacturer's standard, equipment supplier drawings and specification requirements for installation of ESE lightning protection systems.

The installer, at his expense, shall accomplish any corrections required by the inspection.

Noncompliance shall be reported to the equipment supplier for consideration.

PRODUCT STANDARDS

Products

ESE Air Terminal
The complete assembly shall consist of a 5/8” air terminal, which is HD 29 CU, and heavy chrome plated 24 CH. Lock nut and washer shall be chrome plated copper. Support structure shall be chrome plated soft copper. Sphere shall be threaded to the air terminal.

The base of the ESE air terminal shall be threaded for interconnection to top of mast.

Conductors
Copper conductors shall be 28 strands of 14-gauge wire rope lay, with a net weight of 375 pounds per 1,000 feet (60mm2), minimum.

The structural steel may be utilized as the main conductor provided the steel is electrically continuous or is made so via other means.

Bare copper components shall not be installed on dissimilar metals. Corrosion resistant copper equipment shall be utilized where these conditions exist.

Each ESE terminal shall have two (2) paths to ground from the base plate of the mast, with the exception of an elevated mast that may have a single conductor run for a maximum of 16’-0” (4880mm) before two (2) down conductors shall be initiated.

The electrical contractor shall furnish and install all necessary PVC conduit for concealed down conductors.

Mast
Aluminum or stainless steel mast with threaded connection for the ESE air terminal and bonding plate for cable connection. Wind and safety factors shall be documented for the geographic area of installation, to determine the size and structure of mast.

Grounding System
Ground rods shall be copperbond 3/4" x 10'-0”, minimum.

A minimum of one (1) inspection well, rated for the traffic of the installation area, shall be installed for each down conductor or two (2) minimum per ground loop.

Bonding of grounded systems shall be via main size conductors. The bonding shall be accomplished to achieve equal potential of all grounds.

Connectors, Fittings, Fasteners, and Hardware
Provide all connectors, fittings, fasteners, hardware, clamps, guards, lugs, etc., as required to connect, and install all parts of the system.

All equipment shall be fabricated from copper and/or bronze components

Surge Suppression
Provide surge protection on the electrical, telephone, and antenna and TV lead wires.

The surge suppresser for the main electrical panel shall be industrial grade, with replaceable modules, fused, indicator lights.

The electrical surge suppression equipment shall be installed at the main entrance of the electrical system with a disconnecting mechanism.

The surge suppresser shall have the capability of being disconnected without shutting down the electrical system.

The suppresser shall be industrial grade with replaceable modules, and a reaction time of less than one (1) nanosecond.

INSTALLATION GUIDELINES

Installation shall be accomplished in a professional manner by an installer of verifiable ESE system installations.

All work installed within the building shall be concealed.

All work installed in accessible locations shall be properly guarded and protected.

All roof, wall or other building penetrations shall be made in a manner to prevent the ingress of water or moisture.

Roof penetrations, flashings/pitch pans shall be furnished and installed by the roofing contractor.

SECTION 13200

LIQUID AND GAS STORAGE TANKS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains restraints and/or storage racks for laboratory gas bottles.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Gas Cylinder Restraints
Description: Provide metal framing system members, fastened to the wall or laboratory bench, for mounting of cylinder restraint devices.

Metal Framing System Components: Unistrut Corporation, Elcen, Grinnell Power-Strut, or equal. Unistrut Part Numbers are referenced. Paint with color selected by the Owner's Representative.

Chain Restraints: Size 3/16 inch (5 mm) chain, Type 304 stainless steel, length as required to restrain a standard 9 or 10 inch (230 or 250 mm) gas cylinder. Provide male swivel hanger attached to metal framing system member and an oval eye swivel hook, with spring latch, attached to each end of the chain.

Gas Cylinder Storage Rack
Description: Provide metal framing system members, fastened to the wall or laboratory bench, for mounting of cylinder restraint devices.

Metal Framing System Components: Unistrut Corporation, Elcen, Grinnell Power-Strut, or equal. Unistrut Part Numbers are referenced. Paint with color selected by the University's Representative.

Rod Restraints: 0.375 inch (9 mm) diameter, Type 304, polished stainless steel rod. Bend 90 degrees at 1.50 inches (38 mm) from each end. Insert bend ends into 0.375 inch (9 mm) diameter holes drilled into top and bottom horizontal channels.

SECTION 13730

SECURITY ACCESS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general security-related design requirements. These encompass specs for several sections that may be used in putting together final specifications.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Before developing the project design documents, the Project Manager, UNLV's Lock Shop and UNLV Police Services should review and/or determine the security requirements. Provide adequate time to conduct a thorough review of the plans. A minimum of 10 working days is needed to adequately review and comment on the plans.

Entrance Doors
Where feasible, mount the hinges on the interior side of the door. In those instances where egress requirements dictate that hinges be mounted on the outside of the door, install non-removable pins.

Roof Area Access
Examine and design access doors and routes to roof areas to prohibit persons from gaining unauthorized access to these areas. Ensure that doors automatically lock when closed, thereby prohibiting re-entry.

- Install a 1" throw, deadbolt-type lock.

Office and Administrative Areas
Individual departments have internal procedures that address security procedures and operations. A project's design should enhance these procedures and the capability of the department to properly secure their areas of responsibility. Coordinate closely with department and security representatives before renovating an office or administrative area.

Electronic Access Control
All perimeter doors shall be provided with conduit for future electronic access control devices. The UNLV Project Manager shall determine which perimeter doors will receive the electronic access control devices at start up.

The UNLV Project Manager, working with the End User and the Technical Groups, will determine which interior doors are to receive electronic access control devices at start up and which interior doors are to receive conduit only for future electronic access control devices. At a minimum, Computer Labs, Classrooms, and IDF rooms require electronic access control devices at start up.

Electronic access control systems should indicate whether a monitored door is closed or open, locked or unlocked. Electronic access control systems should also be capable of being programmed to initiate a predetermined alarm at the control center for specific conditions.

Do not install electronic access control components, especially heat- and humidity-sensitive components in such areas as mechanical rooms and tunnels that are not compatible with the components.

Electronic access control equipment, such as control panels, modems, and remote or satellite units, should be installed only in secure areas and within locked and secure cabinets.

Lighting
Exterior Lighting

- Use LED lamps for exterior security lighting in pedestrian areas.
- Use LED lamps for parking area lighting.
- The minimum level of foot-candles for walks and other pedestrian passage areas shall be per the current Illumination Engineering Society of North America (IESNA) Recommended Illuminance Levels. Depending upon a given lighting application, lower levels are permitted upon approval by the UNLV Planning and Construction Director of Design.
- The maximum illumination uniformity ratio (average to minimum illumination level) for walks and other pedestrian passage areas shall be per the current IESNA recommended standards.
- To provide some illumination in the event of a lighting failure or vandalism, consider overlapping illumination coverage.
- Illumination patterns (symmetrical, asymmetrical) are determined by the lighting application.
- Where automatic control is required for security and/or safety lighting, use photoelectric sensing devices or other University-approved automatic means to control the lighting. The use of time clock-type switching is not permitted unless approved by the UNLV Planning and Construction Director of Design.

Interior Lighting

- Interior lighting must provide for a safe and secure environment.

Special Lighting

- Special lighting reviews might be required for areas where closed circuit television coverage is required or for loading docks, isolated entryways, and other areas.

Elevators
Equip elevators with an emergency telephone that connects directly to the UNLV Police Services Dispatch. Information concerning the approved types and models may be obtained from UNLV Communications Services.

Emergency telephones installed in elevators and areas of refuge telephones must be "hands free" type and ADA compliant. ADA compliance includes visual signaling indicators for the hearing impaired.

Mechanical Keys

Yale is the standard keying system for UNLV.

Coordinate the re-keying or coring of locks on new projects with the UNLV Lock Shop through the UNLV Planning and Construction Project Manager. All requests to use outside contractors must be routed through the UNLV Lock Shop.

Emergency Phones and Intercoms
The UNLV Telecommunications Services is responsible for the purchase and installation of phones used throughout the University. They also establish the type, model, and manufacturer requirements. Coordinate with UNLV Telecommunications Services on all communications requirements through the UNLV Planning and Construction Project Manager.

Coordinate emergency phone locations with UNLV Police Services through the UNLV Planning and Construction Project Manager.

Emergency phones and intercoms are linked directly to the UNLV Police Services Dispatch. When activated, these devices solicit a police response. Emergency phones may be installed in:

- Designated areas of refuge
- Isolated areas inside academic and administrative buildings
- Outside locations approved by the UNLV Police Services.
- The blue emergency phones are weatherproof, are equipped with other special features, and are recommended for exterior use only.
- In addition to emergency phones, other devices (such as intercoms) may be used for communicating emergencies.

Construction Site Security
During the construction phase, the security of buildings and articles within are of major concern. Contractors who have successfully bid on a project must submit a security plan that encompasses such areas as access control, security guards, hours of operation, point of contact, key requirements, and other factors. Contractors must submit security plans to the UNLV Project Manager for review and approval before beginning the project.

SUBMITTALS

Use the latest edition of the CSI MasterFormat™ for all construction documents. If a summary of the project's security-related requirements is required for review, a cross-reference or a separate listing should be requested from the designer.

SECTION 13760

VIDEO SURVEILLANCE

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for and information for video surveillance equipment and installation.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Summary

- Video surveillance system consisting of cameras, data transmission wiring, and a control station.
- System is integrated with monitoring and control system.

Quality Assurance

- Quality Standard for Installation: NECA 1.
- Electronic Data Exchange: System shall be tied to access control where required.

Materials

- Color Camera: CCD interline transfer, 380,000 771(H) by 492(V) pixels.
- Automatic Color Dome Camera: Dome assembly with color camera, motorized pan and tilt, zoom lens, and receiver/driver.
- Pan and Tilt: Controlled by operator, with 8 user-definable scenes, each allowing 16-character titles.
- Lenses: Optical-quality coated optics, designed specifically for video surveillance applications, and matched to specified camera. Provide color-corrected lenses with color cameras.
- Camera-Supporting Equipment: Rated for the total weight supported times a safety factor of two.
- Protective Housings for Cameras: Steel or 6061 T6 aluminum enclosures.
- Enclosure Rating: NEMA 250, Type 3R.
- Monitors: Color.
- Metal cabinet units designed for continuous operation.
- Horizontal Resolution: 600 lines, minimum, at center.
- Digital Video Recorders: Digital, time-lapse type, full frame and motion and audio recorder, with removable hard drive.

Installation Guidelines
Wiring Method: In raceways, except in accessible indoor ceiling spaces and attics.

Quality Control
Testing: Contractor to align and adjust system and components, verify operation of components, set and name preset positions, and connect and verify responses to alarms.

Warranty
Cameras and Equipment: Three years.

SECTION 13800

BUILDING AUTOMATION SYSTEMS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Any Building Automation and Control System installed at UNLV must be fully compatible and transparent to the existing installed systems. Interface protocol connections must be evaluated and approved by UNLV Energy Management and Controls Systems representatives.

The Honeywell Enterprise Buildings Integrator shall provide the option to monitor and report electrical, gas, water consumption and other energy consumable, billable usage. The ability to correctly monitor and report these consumptions shall be demonstrated to Facilities Maintenance personnel by the Contractor. Measurements, to insure accuracy and operability, shall be by independent instruments. All data retrieved by the system shall be capable of trending and historical data collection methods.

EMCS Standardization
The UNLV campus uses Honeywell as the standard Environmental Management and Control Systems (EMCS). UNLV Facilities Management has standardized the campus EMCS, based on the equipment and technical support provided by Honeywell International, Inc.

The UNLV campus standard is to be maintained, and represents the cost-effective method for campus operation, monitoring and maintenance.

Buildings are monitored and controlled from a central computer station located in the Campus Services Building (CSB).

All EMCS are to be monitored and controlled via the internet to the existing central EMCS computer station.

All projects will be provided with the most current version of software and hardware for the EMCS. Multiple systems must have full access and archiving for all program changes. The EMCS must have full capability for saving of histories data.

Modernization and remodels will comply with this standard.

SECTION 13930

FIRE SUPPRESSION

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for building fire suppression systems. See Fire Protection Specification, Section 15300 for system installation specification details.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General
If not specifically covered in the building design program or mandated by the building code, the architect will decide during the early design stage what types of fire extinguishers, sprinklers, and standpipe systems to include. Also, the insurers will review an early printing of the contract documents. Therefore, schedule a meeting, through the UNLV Planning and Construction, with the State Fire Marshal and with the municipal fire department (Clark County, City of Las Vegas or North Las Vegas) having jurisdiction to discuss the project and its fire protection requirements.

Design Considerations
Fire Protection designs must account for end-user needs and the actual conditions encountered in the field during construction. Coordinate equipment locations with existing and new architectural, structural, and mechanical work.

Construction drawings must reflect, as closely as possible, actual equipment locations and piping routes.

Where possible, surface mount fire suppression system equipment (for example, panelboards, starters, contactors, and control panels) in dedicated electrical rooms so that exposed conduits can be run to the equipment, facilitating future changes. Where dedicated electrical rooms are not available, locate such equipment in mechanical rooms or electrical closets.

Install a fire alarm annunciator panel at the designated Fire Department building access area.

Follow NFPA and IBC requirements for earthquake protection and seismic bracing.

Where possible, all fire sprinkler piping must be concealed or directed.

Combined Systems
The standpipe system and the sprinkler risers can be combined when the system is hydraulically calculated.

Hydraulic Design Versus Pipe Schedule

- Design all sprinkler systems based on the hydraulic design as stated above and NFPA 13. Design systems to include inside and outside hose streams as listed in NFPA.
- Use a pipe schedule only when adding to an existing system that was installed based on a pipe schedule and when adding less than 10 sprinkler heads. If 10 or more sprinkler heads are to be added, then base the entire system for the floor on hydraulic design, and submit drawings.
- If additional sprinkler heads are to be installed on a hydraulically designed system, the addition must be hydraulically designed.

Hydraulically Calculated Fire Protection Systems
Sprinkler systems must be hydraulically designed for each hazard group density in a project based on NFPA requirements, the proposed campus wide high-pressure fire main system, State Fire Marshal requirements, and municipal AHJ requirements.

Water Supplies
Obtain fire pump and hydrant flow test data from the Las Vegas Fire Marshal to determine the water supply available and its pressure at the project location. Obtain data on the campus high-pressure fire mains and fire pumps from the Las Vegas Fire Marshal.

Piping Mains
The fire main minimum piping size must be:

- 10" underground or 8" above ground. (If a building has a fire main loop and it is connected at both ends, a 6" main may be used.)
- 6" loop within a building
- 8" feeder for a building from the express main
- 10" express mains for more than one building

Multiple Water Feeds to a Single Area
Fire mains on each floor must have only one control valve per section. If more than one supply is needed on a floor, split the system with a separate supply for each section of the building, No area may have more than one supply (for example, no cross-connection of mains).

Factors Influencing the Water Demand for Sprinklers
The water demand required for sprinkler protection depends upon occupancy, discharge density, design area, type of sprinkler system (wet or dry), type of construction, and other building features.

Water Demand for Sprinklers
Use Table 1 to determine the water demand required for sprinklers.

Design Densities
Design densities in Table 1 are minimum densities. Each sprinkler in the design area must discharge at least the flow rate require to produce the stipulated density.

Design Area
The design areas shown in Table 1 are the most hydraulically-remote areas.

Water Demand for Hose Streams
Hose streams are needed concurrently with sprinkler discharge to achieve final extinguishment or to wet down adjacent structures. Use Table 1 to determine the hose for sprinklered occupancies.

Total Water Demand for Sprinklered Occupancies
The total water demand for sprinklered occupancies is equal to the sum of the domestic demand plus the sprinkler system(s) water demand and the hose stream(s) demand. The total demand must be available at the sprinkler system connection to the underground main, and at the pressure necessary to produce the required sprinkler density over the required, most hydraulically-remote area of sprinkler operation.

Table 1. Water Demands for Sprinklered Facilities

Occupancy Classification	**Sprinkler**		**Hose Gal/Min**
	Design Density (Gal/Min)/Sq Ft	**Design Area SqFt[1]**	
Light Hazard	0.10	1500	100
Ordinary Hazard Group 1	0.14	2000	250
Ordinary Hazard Group 2	0.19	2000	250

1 For dry pipe and preaction systems, increase design area by 30 percent.

System Types
All systems must be wet pipe, except in areas subject to temperatures below 40°F, which must have a dry pipe system installed.
Install dry pipe systems in all areas subject to temperatures below 40°F, such as attics and unheated areas.
Use a pre-action system only in areas where water damage by accidental activation or damage to a sprinkler head is of most concern.

Occupancy Classifications
Light Hazard
- Dwelling units
- Chapels
- Classrooms
- Libraries, except stack areas
- Offices
- Data processing or computer rooms
- Theaters and auditoriums, except stages and prosceniums

Ordinary Hazard I
- Dining hall service area
- All laboratory units

Ordinary Hazard II
- Attics and basements used for storage
- Library stack areas
- Mechanical rooms

- Custodial rooms
- Stages

Protection of Domestic Water Supplies
Install a reduced-pressure back-flow preventer (RPBFP) on all fire sprinkler or standpipe systems, as required by the regional water authority, but not on the main since it already has at least one RPBFP. Include any pressure reduction in the system hydraulic calculations. Install the back-flow preventer inside the building, with control valves before and after the unit. Pipe the drain to a proper drain location, such as outside, to a sump pit, or to a floor drain that is in good condition. Verify the condition of all drains before any piping is done. Install the back-flow preventer after the fire pump, per NFPA 20.

Main Drain Capacity
Pipe all main drains from the sprinkler system and standpipe system to a proper drain location that can handle both water supply testing and draining of the systems. Proper drains are from alarm check valves, dry pipe valves, pre-action valves, deluge valves, riser valves, and sectional drain connections, including drain lines at floor control valves. These drains must be piped outside the building or to a sump pit that can handle a flow of 250 GPM for at least 3 minutes. Size the main drain per NFPA 13.

Valves: Above Ground and Within Buildings
All control valves must be butterfly valves. Each valve must have a built-in tamper switch and two sets of contacts. Connect the tamper switch to the building fire alarm system as a separate point or zone and as a supervisory alarm (trouble), but not on the same point or zone of any alarm-causing device. All valves must be left hand to open (counter-clockwise).

Valves: Underground
All curb boxes, post indicator valves (PiVs), and other control valves must be left hand to open (counter-clockwise). All PIVs must include a tamper switch with two sets of contacts.

Roof Manifolds
Provide roof manifolds, as required, to test the standpipe system for proper flow and pressure at the top of the most remote riser. Provide all manifolds subject to freezing with a butterfly valve that includes:
- Tamper switch
- Auxiliary drain with valve
- Hose connection and cap above the control valve

Pipe Identification
Provide color-coded pipe identification markers. Pipe markers must be snap-on laminated plastic with an acrylic coating applied after architectural painting.

Provide an arrow marker with each pipe content marker to indicate direction of flow. If flow can be in either direction, use a double-headed arrow marker.

Label mains as follows:
- At points of entry and exit from the mechanical room
- At points of entry and exit from the building
- Next to valves
- On risers

- At tee fittings
- At least once in each room
- At intervals not longer than 20 ft
- Label piping with SETON pipe marking system as per NFPA13.

Table 2. Pipe Marker Identification

Service	Legend	Background Color
Sprinkler	Sprinkler	Red
Combined Sprinkler - Standpipe	Sprinkler - Fire	Red
Fire	Fire	Red

Provide valve tags on fire protection valves and valve charts. Valve tags must list the building and valve number. The chart must be wall-mounted, and its location coordinated with the State Fire Marshal.

No Piping shall be routed above electrical equipment, per NEC Section 110.26 (F).

All standpipes, must be 6" ID, except in the residential colleges where by hydraulic calculation they can be 4" ID.

Fire Department Connections connectors must use threads designated by the NFPA 13.

Provide fire plugs with threaded connections per Fire Marshall Requirements.

Provide NIC portable fire extinguishers. IBC or NFPA Standards will specify the size. Portable fire extinguishers are usually mounted in recessed cabinets with doors, and are usually located in egress areas in or near egress stairwells. The architect/engineer will determine additional locations. Extinguishers must be mounted with the top a maximum of 60 inches above floor.

Submittals
Designer submittals must include the following:
- Preliminary calculations to determine water flow requirements and the need for a fire pump
- Fire pump selection and pump curve
- List of fire protection equipment, including the manufacturers' name and model or catalog number
- Owner's certificate (as outlined in NFPA 13, Chapter 4)

Product Standards
Products must conform to the following standards:
- Color banding must meet the latest ANSI and OSHA requirements.
- Use only Underwriters Laboratories- or Factory Mutual-listed items.

Manufacturers
See UNLV Fire Protection Specification, Section 15300.

Materials

See UNLV Fire Protection Specification, Section 15300.

Installation Guidelines

See UNLV design standard for Fire Protection Specialties, Section 15310.

Quality Control

Contractor directions must include the following:

- Arrange for the testing of completed units of work in successive stages in each area. Do not proceed with the next system and area until the test results for the work completed previously is verified to be following the design requirements.
- Provide a contractor's material and test certificate for below- and above-ground piping. Underground piping is to remain uncovered until inspected by AHJ as per code.
- Provide the services of a factory-authorized service representative to supervise the field assembly of components and the installation of the fire pump, including piping and electrical connections. Report the results in writing.

If incorporating commissioning into this portion of the project, verify that:

- Specification insertions to this section have been made that reference commissioning procedures and the commissioning specification section.
- This section does not conflict with commissioning procedures for testing and training.

SECTION 14200

ELEVATORS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for elevators.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Equipment Selection:

For rise up to 45 feet or 4-stops – Select hydraulic type elevator machine. Piston stabilizers, telescoping pistons, or “roped hydros” are not allowed. Holeless installations are permitted.

For rise above 45 feet or greater than 4-stops – Select electric traction machines.

Elevator Speed

Electric traction elevators
- Freight minimum: 200 fpm
- Passenger minimum: 350 fpm
- Service minimum: 250 fpm

Hydraulic elevator
- Freight minimum: 80 fpm
- Freight maximum: 100 fpm
- Passenger minimum: 100 fpm
- Passenger maximum: 160 fpm

Hydraulic pump for freight elevators to be dry only; hydraulic pump for passenger elevators, submersible is permitted.

Controller – Specify non-proprietary microprocessor controls (mandatory unless written exception is granted by UNLV). Refer to section 1.A for approved equipment manufacturers. Where a written exception is granted, proprietary controllers requiring proprietary diagnostic tools used for set up, adjustment or troubleshooting of any part of the system must be provided to UNLV at no additional cost. Controllers and tools must include a complete set of use instructions. If periodic reprogramming of the tool is required, this service will be provided by the elevator company, at no additional cost to UNLV, for the life of the equipment. In addition, electric traction elevators must have SCR drive or

Variable Voltage Variable Frequency drive (VVVF).

Hydraulic Elevator Cylinder Unit – Provide an outer cylinder casing using at least schedule 30 steel pipe. Provide a PVC liner (Schedule 40, ½” wall thickness) between outer casing and cylinder unit, sealed at the bottom. Use only clean, silica sand to fill void between outer casing and the liner and between the liner and the cylinder unit. Seal the top of the PVC/ cylinder casing with epoxy resin to prevent any moisture being absorbed by the sand. Provide PVC protection for underground pipelines.

Door Panels – Use single speed door operation only, side slide or center opening.

Door Protection – Do not specify incandescent type light beams or mechanical safe edges. Specify infrared type multi-beams – full door curtain type only. Provide differential timing feature and nudging.

Automatic Freight Door Closer – If an automatic door closer is utilized, an alarm must sound prior to and during door closing. The vertical gate must be equipped with an infrared reopening device.
Roller Guides – The roller guides are not to be fixed but spring loaded adjustable. Slide guides must be approved by UNLV.

Position Indicators to be LED Digital Display.

All rails shall be “T” rails.

All selectors/ landing control systems shall be non-proprietary.

“No load”, “Rated load” and “Relief pressures” of hydraulic elevators shall be permanently marked on each individual controller.

Design coordination:

Do not locate elevators or dumb waiters directly off of a corridor line. Inset elevator a minimum of six feet.

Do not locate passenger elevators and freight elevators within the same core.

Provide minimum of 12 feet of width for passenger elevator lobbies and 14 feet of width for service elevator lobbies.
Do not design elevators with both front and side openings.

Do not exceed 40 feet rise for hydraulic elevators.

Do not locate elevators over occupied areas.

Do not place 4 or more elevators in a straight line.

SUBMITTALS

Manuals - all information must be submitted to the Owner’s Representative within 30 days prior to the acceptance of the elevator installation. Acceptance will be delayed until all specified information is received, reviewed and approved by the Owner’s Representative. The information shall include, but not be limited to the following:

Supporting mechanical and software manuals with appropriate diagnostic means for the necessary maintenance, adjustment and diagnostic function of the group dispatch, car control and motion control systems. The diagnostic means, which shall be the property of the Owner, may be a hand held “smart” tool or may be integrated into the control system. If a hand held tool is provided, it shall be programmed for the specified elevator system only.

Complete wiring diagrams of “as-installed” elevator circuits with index of location and function of all components.

Complete lubricating instructions and frequency charts, including recommended grade of lubricants.

Complete parts catalogs for all replaceable mechanical or solid-state components, including ordering forms and instructions.

Manufacturers

Approved Equipment Manufacturers:

Micro-Processor Based Controller

For traction elevators:

- Motion Control Engineering Model with SCR Drive or VVVF or Swift/Computerized Elevator Control, Corp.

For hydraulic elevators:

- Motion Control Engineering Model HMC 1000 or Elevator Controls Corp. with electronic soft start features to limit inrush current and remote diagnostics.

Door Operator & Equipment (Passenger)

- GAL Manufacturing Corp Model MOVFR.

Door Operator & Equipment (Freight)

- Peele
- EMS Group, Inc.

WARRANTY

Lifts shall carry a warranty of one year for labor and parts. Full service maintenance by trained employees shall be provided for a period of 9 months to run concurrently with the warranty. One-year warranty shall be honored regardless of service contractor as long as the contractor is licensed by the State of Nevada.

Start-up and Training

Maintenance

After completion of the installation, maintenance and 24-hour callback service for the equipment shall be provided for a period of nine months as a part of the contract. The service shall also include regular examination (biweekly; advise UNLV Facilities Department each time after completion of service) of the installation during regular working hours by trained employees of the Contractor, and shall include all necessary adjustments, greasing, oiling, cleaning, supplies and parts to keep the equipment in proper operation, except parts made necessary by misuse, accidents or neglect caused by others. Contractor shall conduct a “walk through” with the UNLV Facilities Department on the last scheduled maintenance visit. UNLV shall obtain a signed letter certifying all equipment that is required to be left on the site has been signed over to UNLV.

All maintenance service must be performed by the installers and not by any other services agency. Also, the installer must have an established maintenance and service organization available for performance in the City of Las Vegas that can provide regular and emergency service, 24 hours a day, every day of the year and respond to the job site within two hours of a call. If the emergency is for an “occupied” elevator, the response time shall be within twenty minutes of the call.

SECTION 14300

ESCALATORS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for escalators.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

The diagnostic means, which shall be the property of the Owner, may be a hand held “smart” tool or may be integrated into the control system. If a hand held tool is provided, it shall be programmed for the specified escalator system only.

State in specifications that escalators requiring proprietary diagnostic tools are not allowed unless a written exception is granted by UNLV. Where a written exception is granted, proprietary diagnostic tools used for set up, adjustment or troubleshooting of any part of the system must be provided to UNLV at no additional cost. Tools must also include a complete set of use instructions. If periodic reprogramming of the tool is required, this service will be provided by the elevator company, at no additional cost to UNLV, for the life of the equipment.

SUBMITTALS

All escalator shop drawings must be submitted to UNLV for approval.

WARRANTY

Escalators shall carry a warranty of one year for labor and parts. Full service maintenance by trained employees shall be provided for a period of 9 months to run concurrently with the warranty. One-year warranty shall be honored regardless of service contractor as long as the contractor is licensed by the State of Nevada.

Start-up and Training

Maintenance

After completion of the installation, maintenance and 24-hour callback service for the equipment shall be provided for a period of nine months as a part of the contract. The service shall also include regular examination (biweekly; advise UNLV Facilities Department each time after completion of service) of the installation during regular working hours by trained employees of the Contractor, and shall include all necessary adjustments, greasing, oiling, cleaning, supplies and parts to keep the equipment in proper operation, except parts made necessary by misuse, accidents or neglect caused by others. Contractor shall conduct a “walk through” with the UNLV Facilities Department on the last scheduled maintenance visit.

UNLV shall obtain a signed letter certifying all equipment that is required to be left on the site has been signed over to UNLV.

All maintenance service must be performed by the installers and not by any other services agency. Also, the installer must have an established maintenance and service organization available for performance in the City of Las Vegas that can provide regular and emergency service, 24 hours a day, every day of the year and respond to the job site within two hours of a call. If the emergency is for an “occupied” elevator, the response time shall be within twenty minutes of the call.

SECTION 14400

VEHICLE WHEELCHAIR LIFTS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for vehicle wheelchair lifts.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Lifts shall have a minimum 700-pound capacity.

Manufacturers
- Submit manufacturer to UNLV for approval.

WARRANTY

Lifts shall carry a warranty of one year for labor and parts. Full service maintenance by trained employees shall be provided for a period of 9 months to run concurrently with the warranty. One-year warranty shall be honored regardless of service contractor as long as the contractor is licensed by the State of Nevada.

Start-up and Training

After completion of the installation, maintenance and 24-hour callback service for the equipment shall be provided for a period of nine months as a part of the contract. The service shall also include regular examination (biweekly; advise UNLV Facilities Department each time after completion of service) of the installation during regular working hours by trained employees of the Contractor, and shall include all necessary adjustments, greasing, oiling, cleaning, supplies and parts to keep the equipment in proper operation, except parts made necessary by misuse, accidents or neglect caused by others. Contractor shall conduct a “walk through” with the UNLV Facilities Department on the last scheduled maintenance visit. UNLV shall obtain a signed letter certifying all equipment that is required to be left on the site has been signed over to UNLV.

All maintenance service must be performed by the installers and not by any other services agency. Also, the installer must have an established maintenance and service organization available for performance in the City of Las Vegas that can provide regular and emergency service, 24 hours a day, every day of the year and respond to the job site within two hours of a call. If the emergency is for an “occupied” lift, the response time shall be within twenty minutes of the call.

SECTION 15010

GENERAL MECHANICAL DESIGN REQUIREMENTS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains General Mechanical Design information that relates to all Mechanical sections.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

HVAC, plumbing, and fire sprinkler systems shall be designed to comply with the requirements of the adopted codes and regulations listed in Section 2, with the most current edition of following reference standards as applicable to each specific project:

- ASHRAE Handbooks
- ASHRAE Standards
- International Energy Conservation Code and/or ASHRAE/IESNA Standard 90.1
- SMACNA Duct Construction Standards
- ASPE Data Books
- Nevada Administrative Code Chapter 455C (Boilers, Elevators, and Pressure Vessels)
- Energy Conservation

Mechanical and plumbing systems shall be designed and documented to comply with the requirements of the International Energy Conservation Code and/or ASHRAE/IESNA Standard 90.1.

In accordance with NRS 338.190, prior to the construction or renovation of any public building with a gross floor area greater then 20,000 square feet, a detailed life cycle cost analysis including the cost of operation and maintenance, must be completed. The study shall identify measures for the conservation of energy (and shall consider the use of alternate non-fossil fuels when applicable). The analysis shall include comparisons of at

least three different HVAC system types. The three different system types to be evaluated shall be reviewed and approved by UNLV prior to beginning the analysis. A separate narrative shall be provided outlining the building envelope insulating values (for walls, glass, roof, etc.) and specific HVAC system components (i.e. plate and frame heat exchangers, variable frequency drives, compensating type kitchen exhaust hoods, etc.) as they relate to energy conservation.

All Buildings shall comply with the minimum building sustainability design standards as defined by Owner for each project (typically a 20% reduction in both energy and water consumption beyond the values allowed by ASHRAE/IESNA Standard 90.1-2004).

All motors one horsepower and larger shall be specified to be premium/high efficiency type with full load efficiencies equal to or great than those recommended by ASHRAE/IESNA Standard 90.1.

HVAC Systems and Equipment

HVAC systems and equipment shall be designed in conformance with all applicable sections of the ASHRAE Handbooks and ASHRAE Standards (e.g., ASHRAE Standards NO. 15, 55, 62, 90.1 etc.). The most current edition of all ASHRAE Handbooks and Standards shall be utilized.

Preferred base line system: VAV Air Handling systems with VAV terminal units with reheat coils, using the chilled water and heating hot water as a cooling and heating source. The Design shall agree with ASHRAE 90.1-2007 and the ASHRAE AEDG for K-12 schools.

All selected systems must incorporate air side economizers and water side tower free cooling through plate/frame heat exchangers.

Preferred systems at UNLV. Water cooled central plants, single zone air handling systems, VAV air handling systems with terminal reheat.

Acceptable systems: Water cooled packaged RTV's with VAV terminal units with reheat. Air cooled equipment is acceptable but not preferred and should be pre-approved by UNLV.

Non-acceptable systems: Multiple small RTV's and multiple water source heat pumps, maintenance intensive.

Life cycle cost analysis shall be presented for each project
including the first costs, utility costs and maintenance costs. Energy consumption should be evaluated in detail indicating all ECM's (energy conservation measures).

Heating and air conditioning load calculations shall be completed utilizing the following criteria:

- Indoor Outdoor
- Heating 72°F ASHRAE 99.6% Winter Value
- Cooling 74°F ASHRAE 0.4% Summer Coincident Values

Heating and air conditioning load calculations shall not incorporate safety factors. Any safety factors deemed appropriate shall be applied in equipment selections and/or in coil selections but in no case shall the applied safety factors exceed 15% of the calculated load for that element of the mechanical system.

Minimum outside air calculations shall be based on the anticipated maximum occupant load as determined by the Consultant in cooperation with UNLV. Minimum outside air calculations shall not be based on the life safety exiting occupant load.

All equipment and equipment rooms shall be designed to ensure adequate provisions for service, maintenance, and removal/replacement of equipment, filters, controls, etc. Special consideration shall be given to ensure proper clearances for maintenance and removal of chiller and boiler tubes, fan housings, fan shafts, and filters.

Access to equipment for service and maintenance shall be thoroughly coordinated with UNLV. Required clearance areas shall be specifically identified on the drawings (for equipment such as fan coils, variable air volume boxes, indoor air handling units, etc.). Coordinate with other disciplines to ensure that other trades (electrical, fire sprinkler, etc.) are made aware of the required clearances.

Boilers for critical use and/or emergency response facilities shall be configured to allow for a loss of the primary fuel source. The most practical and cost-effective approach may be to provide natural gas boilers with a back-up boiler that utilizes propane gas.

The specifications for projects that include a boiler, chiller, or other pressure vessel shall require that the Contractor apply for and obtain all required inspections and operating permits (as required by the Nevada Department of Business and Industry, Division of Industrial Relations, Occupational Safety and Health Enforcement Section).

Rooms containing electrical equipment (transformers, switchgear, telephone, data equipment, etc.) shall be thoroughly reviewed and coordinated with the architect, the electrical engineer, and UNLV to ensure that service clearances and cooling requirements are appropriately defined and addressed. Use building exhaust system for the electrical rooms whenever possible. Provide a dry cooler system for the cooling of the IDF rooms and data rooms in winter season when the central plant is down.

Project specifications shall limit the length of the flexible ducts to a maximum of 6 feet.

SUBMITTALS

Refer to specific sections for identified submittal requirements.

SECTION 15056

COMMON MOTOR REQUIREMENTS FOR ALL HVAC EQUIPMENT

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general HVAC design criteria for electric motors.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Unless otherwise specified, provide constant speed, TEFC, squirrel cage induction motors per NEMA Design B.

Unless totally enclosed, motors must have a 1. 15 service factor.

Motors must have Class B insulation.

Unless otherwise specified, design motors under 1/2 hp for 120 V, 60 Hz, single-phase.

1/2 hp motors and over must be as required in schedules.

See UNLV specification 15950, Energy Management and Controls Systems, variable-frequency drives.

All motors must be high-or premium-efficiency. All motors over 5 hp must be premium-efficiency. Motors for variable-frequency drives must be high-efficiency.

Do not select motors based solely on how they operate in their service factors.

Select all motors to be non-overloading throughout the fan or pump service operating range.

Specify that all motors must be aligned with driven equipment.

PRODUCT STANDARDS

Motors must conform to NEMA Standard MG-1-12.53a. Determine motor efficiencies in accordance with IEEE Standard 112 Method B. List the NEMA nominal efficiency on the motor nameplate.

MANUFACTURERS

Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

- Baldor
- Lincoln
- General Electric
- U.S. Motors

INSTALLATION GUIDELINES

Provide sufficient clearance for motor maintenance and removal upon completion of construction. Allow a minimum clearance of 2" 6" around the motors. In locations where a portable hoist cannot be maneuvered, such as within air handling units, install horizontal lift beams with hoists for motors over 100 pounds.

SECTION 15061

HANGERS AND SUPPORTS FOR HVAC AND PLUMBING, PIPING, AND EQUIPMENT

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for the support and hanging of HVAC and plumbing piping and equipment including piping exposed on roofs.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Provide complete support systems, including bases, framing, supports, anchors, hangers, rollers, clamps, guides and other devices required for supporting piping and ductwork on roof and elsewhere as indicated.

All piping and suspended equipment in mechanical rooms shall be provided with vibration isolation via adjustable-acoustically isolated spring hangars, like Mason PCN-30N.

All hangers and anchorages shall be as a Nevada registered Professional Engineer has prepared the calculations, and stamped and signed. Calculations must be submitted to authority having jurisdiction, and approved before commencing work or ordering parts.

Piping and ductwork on roof shall be supported by an engineered prefabricated structural steel frame system specifically designed to be installed on the roof without roof penetrations, flashing or damage to the roofing material. The system shall consist of rubber and plastic bases, structural steel frame, and suitable hangers and supports. The system shall be designed to fit the piping, ductwork, and conduits to be installed and the actual conditions of service.

Bases
Injection molded and pressed, recycle plastic and rubber conforming to the following:

- Bases shall be sized as required, and as designed for weight of pipes to be supported, fabricated in the shop with inserts for square tubing or threaded rods as required.

Framing
B-Line 1-5/8 B22TH or 1-7/8" BTS22TH, fabricated of steel conforming to ASTM A570, Grade 33. Framing shall be roll formed of 12 gage (2.7 mm thick) steel into 3 sided or tubular shape. Tubing shall be perforated with 9/16" (47.6 mm) holes at 1-7/8" (47.6 mm) centers on 3 sides.

Pipe Supports and Hangers
Conform to MSS SP-58 and MSS SP-69. Supports and hangers shall be fabricated of carbon steel where framing is carbon steel.

Duct and Equipment Supports
Factory fabricated to support exact duct sizes and equipment to be installed, from B-Line 1-5/8" B22TH and 1-7/8" BTS22TH 3 sided channels, and bases as specified above.

Roof Walk
Factory fabricated of bases as specified above, tubular sections and galvanized, slotted metal grating, in configuration as indicated. Provide tubular handrails where shown.

Accessories
Provide all clamps, bolts, nuts, washers, and other devices as required for a complete system.

Bases
Black color as molded.

Accessories or Special Features

Finishes

Metal Surfaces

Metal framing, supports and hangers shall be hot dip galvanized after fabrication.

Produce coatings free of roughness, whiskers, unsightly spangles, icicles, runs, barbs, sags, droplets, and other surface blemishes.

Galvanizing shall conform to ASTM A123 for tubing and ASTM A153 for hardware and accessories.

INSTALLATION GUIDELINES

Verify that roofing system is complete, and that roof surfaces are smooth and flat and are ready to receive work.

Verify that roof temperature is a minimum of 60 degrees F. (15.5 degrees C.) for proper adhesive performance.

Use care in installation of portable pipe support systems not to damage roofing, flashing, equipment or related materials.

Bases and support framing shall be located as indicated
on drawings and as specified herein. The support of all piping shall be complete and adequate, whether or not all required devices are shown.

The use of wood or wire for supporting piping will not be permitted.

Deflection of pipes shall not exceed 1/240th of the span.

Framing system shall be installed at spacings indicated, but in no case should spacing exceed 10' (3 m.) centers.

Set bases with adhesive in accordance with manufacturer's installation instructions. Accurately locate and align bases. Where applicable, replace gravel around bases.

Set framing posts into bases and assemble framing structure as indicated.

Use galvanized fasteners for galvanized framing, and use stainless steel fasteners for stainless steel framing.

SECTION 15076

IDENTIFICATION FOR ALL HVAC EQUIPMENT

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for mechanical systems identification. See Section 13915 for fire suppression system identification. Consultants shall provide as part of each schedule a column with header called “Tag Number”. This number shall be provided by UNLV Facilities Management, and included with the contract documents when issued for bid, and be included on all equipment tags for equipment and in the “Record Documents”. Tag number shall be shown as numerics and in a Bar Code Format on all equipment.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Ensure that identification systems are compatible with existing systems and are consistent throughout the project. Provide for future additions to the systems.

Plumbing Systems Identification

Provide color-coded pipe identification markers on piping installed per this section. Use snap- on, laminated, plastic pipe markers protected with a clear acrylic coating. Apply pipe markers after architectural painting where such painting is required.

Provide an arrow marker with each pipe content marker to indicate the direction of flow. If flow can be in either direction, use a double-headed arrow marker.

Pipe markers must have legends and color coding with black letters. Apply markers to all piping per Table 1, regardless of all under-jacket colors.

Table 1. Pipe Marker Color Coding

Service	Legend	Background Color
Cold water	Cold water	Green
Hot water	Domestic hot water	Yellow
Hot water return	Domestic hot water return	Yellow
Protected cold water	Protected cold water	Yellow
Protected hot water	Protected hot water	Yellow
Protected hot water return	Protected hot water return	Yellow
Non-potable water	Non-potable	Yellow
Compressed air	Compressed air	Green
Sanitary	Sanitary Sewer	Green
Vent	Vent	Yellow

Rainwater	Storm Sewer	Green
Pump discharge	Pump discharge	Green
Pure water	Pure water	Green
Vacuum	Vacuum	Green
Central vacuum	Vacuum	Yellow
Lab waste	Lab waste	Yellow
Lab vent	Lab vent	Yellow
Reclaimed/Gray water	Gray water	Purple
Tempered water	Tempered water	Green
Tempered water return	Tempered water	Green

Use colored PVC jackets in penthouses, plumbing rooms, shipping docks, janitor's closets, and other areas without hung ceilings. Cover all insulated plumbing piping exposed in mechanical rooms with a Ceel-Co plastic jacket. The system identification and color pattern legend must be per Table 2.

Table 2. System Identification and Color Patterns

Piping System (and Legend)	Color
Potable Cold Water	Green, Blue,
Potable Hot Water	Green. Blue.
Non-Potable Cold Water	Yellow. Gray.
Non-Potable Hot Water	Yellow. Gray.
Storm Drain	Purple.
RODI Water	Yellow. White.
Gray Water	Purple. Blue
Tempered Water	Green. Blue

Plastic jackets include fitting and piping covers.

Insulate and finish the piping to be covered with plastic jackets, per this section, then apply the plastic jackets.

Tags, Valves, Equipment, and Instruments

Upon completion of work, attach engraved laminated plastic tags to all valves and instrumentation. In every mechanical space, tags must be seen when hung with valve/riser charts.

Equipment must bear stamped, stainless steel tags.

Tags must be numbered consecutively with black characters on a white face. Numerals must be at least 3/8" high.

Embossed or engraved aluminum or brass tags may be substituted for stainless steel or laminated tags, if desired.

Tags must be at least 1" in diameter, at least 1/8" thick, and attached by S-hooks and chains.

HVAC Systems Identification

Stencil ductwork at each junction or branch takeoff, at least once in each room, and at intervals not longer than 20 feet. Stencils must clearly identify the duct service area (S for supply, R for return, X for exhaust) served by the branch, and must include an
arrow indicating the direction of flow.

Provide color-coded pipe identification markers on piping installed per this section. Use snap-on, laminated, plastic pipe markers protected with a clear acrylic coating. Apply pipe markers after architectural painting where such painting is required.

Provide an arrow marker with each pipe content marker to indicate the direction of flow. If flow can be in either direction, use a double headed arrow marker.

Label mains

- At points of entrance and exit from mechanical rooms
- Adjacent to each valve
- On each riser
- At each tee fitting
- At points of entrance and exit from building
- At least once in each room
- At intervals no longer than 20 ft
- The size of legend letters on markers and the length of the color field must be per the latest edition of ANSI.

Use the color-coding in Table 3, with names in black letters on a white background and white letters on a green background.

Table 3. Pipe Marker Color Coding

Service	Legend	Background Color
Chilled water supply	CHWS	Green
Chilled water return	CHWR	Green
Hot water supply	HWS	Yellow
Hot water return	HWR	Yellow
Cold water	Cold water supply	Green
Low pressure condensate return	LPR	Yellow
Medium pressure condensate return	MPR	Yellow
High pressure condensate return	HPR	Yellow
High pressure steam	HPS	Yellow
Low pressure steam	LPS	Yellow

Medium pressure steam	MPS	Yellow
Pumped condensate	PC	Yellow
Steam	Steam	Yellow
Glycol supply	GS	Yellow
Glycol return	GR	Yellow

PRODUCT STANDARDS

Color banding must meet the latest ANSI and OSHA requirements.

Manufacturers
- Ceel-Co plastic jacket
- Seton Name Plate Corporation
- Marking Services Incorporated
- Approved equal

MATERIALS

Use Setmark markers by the Seton Name Plate Corporation, or approved equal.

INSTALLATION GUIDELINES

Mains shall be labeled at points of entrance and exit from mechanical room, adjacent to each valve, on each riser, at each tee fitting, at points of entrance and exit from building, at least once in each room, and at intervals no longer than 20'.

In general, use 2" high legends for 4" and larger diameter pipe lines, and 3/4" high legends for pipe lines 3" diameter and smaller pipe lines.

Use screws or rivets to securely attach nameplates, catalog numbers, and rating identifications to mechanical and electrical equipment. The use of adhesives or cements is not permitted.

Identify non-potable water outlets with permanently attached, yellow color-coding or 4" high triangle tags that read "Non-potable Water."

Coordinating the numbering system, with existing piping tags to avoid duplicate numbers.

SECTION 15083

HVAC AND PIPE INSULATION

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for piping insulation and jacketing.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Verify with the UNLV Facilities group that information related to insulation and jacketing is the most recent.

Insulation must be fiber glass insulation with a factory-applied, fire retardant, vapor barrier jacket and a K factor of at least 0.23 at a mean temperature of 75°F. ASTME-84 fire hazard ratings must be 25 flame spread, 50 smoke developed and 50 fuel contributed.

Refer to Table 1. for UNLV pipe insulation thicknesses.

Table 1. Pipe Insulation Thicknesses for UNLV Insulations

Pipe Insulation Thicknesses for UNLV Insulations							
		Steam					
Hrs. of Operation & Bldg. Types	"lOpsi	30-125 psi	250 psi	Condensate Return	Chilled Water/ CHWR	Domestic Hot Water/ HWR	Hot Water Heating/ HWS/R
8700 hrs./yr. Distr. systems & lab bldgs.	1.5"	2"	4"	1.5"	4"	1"	1.5"
4000 hrs./yr. Non-lab bldgs.	1"	2"	2*	1"	2"	1"	1.5"

Subject to change for individual projects, chilled water insulation directives must be as follows:

Insulate all chilled water return piping and all chilled water supply piping.

Manufacturers
Subject to compliance with the design requirements, provide products by one of the following manufacturers:

Insulation
Dow Corning Trymer 2000 XP or approved manufacturers subject to UNLV approval.

Insulation Jacketing
Subject to compliance with the design requirements, provide products by one of the following manufacturers:

- Advanced Thermal Corporation, represented by:
  Powers & Process, Inc., 1168 Farmington Avenue, Kensington, CT 06037
- D&N Insulation Company, 88 Farwell Street, West Haven, CT 06516
- Shannon Enterprises of WNY, Inc., represented by:
  Components & Controls, Inc., 256 Oakwood Drive, Glastonbury, CT 06033

MATERIALS

Insulate chilled water distribution piping with polyurethane foam wrapped with glass fabric and then coated to insure watertight integrity.

INSTALLATION GUIDELINES

Install pipe insulation as required by the manufacturer.

All supports, hangers, etc. shall be outside the insulation vapor barrier and protective jacket.

Chiller evaporative barrels shall be factory insulated with an elastomeric closed cell insulation that meets the smoke contribution/flame spread requirements for use in a return air plenum.

Chiller evaporative end Bell caps shall be insulated with a 40 mil thick layer of Mascoat DTI GEN2.

All other chilled water equipment and pipe fittings, such as pumps, valves, flow sensors, side stream filter housings, expansion tanks, air separators, shall be covered with a 40 mil layer of Mascoat DTI GEN 2.

Heating hot water systems and equipment shall be covered with a 40 mil of Mascoat DTI GEN2.

SECTION 15100

PIPING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

All pipe and fittings shall comply with the applicable ASTM Standards for the materials intended use.

Foreign manufactured materials must submit proof of compliance prior to bidding, and must be approved prior to submitting a bid.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Piping and/or ductwork shall not be routed in the dedicated electrical space at or above electrical switchboards, distribution boards, motor control centers, etc. (as prohibited by 2002 National Electrical Code Section 110-26F), particularly applicable at chiller rooms, boiler rooms, electrical rooms and data/server rooms.

Locate fan coil units serving data/electrical rooms outside of the data/electrical room being service (so that piping does not end up being routed in the dedicated electrical space and/or over sensitive data/electrical equipment).

Require that the bottom of all air handling unit pipe chases be insulated and sealed air and water tight.

Provide location of differential pressure sensors for chilled water system and heating water system secondary pump vfd control (locate differential pressure sensors on the appropriate piping plans).

Indicate where 3-way valves will be incorporated in the chilled water and the heating water piping systems to ensure that the secondary pumps cannot be operated at a no-flow condition. Typically this requirement can be accomplished by specifying all valves as 2-way except for 3-way valves at one air handling unit (or at all fan coil units).

Indicate required type of balancing valve at all chilled water and heating water coils (manual balancing valves versus automatic pressure-compensating valves). Valves in variable flow pumping applications should typically be automatic pressure-compensating type valves.

Specify/note that temperature/pressure test ports are to be installed immediately at connections at each chiller, at each plate heat exchanger, and at each heating and/or cooling coil.

Provide isolation valves at or near the plate heat exchanger to facilitate periodic removal of port filters for cleaning. Provide notation requiring that isolation valves be installed as close as possible to the heat exchanger (to ensure a minimal loss of treated water when heat exchanger is drained to clean port filters).

Provide a drain valve with a hose connection at the low point in the piping at both the cold side and warm side of the plate heat exchanger (to facilitate drain-down for removal and cleaning of port filters).

List required chilled water system and heating water system fill pressure and expansion tank charge pressure.

List required chilled water system and heating water system relief valve pressures.

Provide a 12” high inverted loop in the condenser water return piping at each cooling tower (to prevent overflow of tower basin when condenser water pumps are shut off).

Specify/note that all heat traced piping exposed outdoors is to be insulated with closed cell polyisocyanurate insulation (Dow Trymer, or approved equal) and covered with aluminum jacketing.

SECTION 15111

GENERAL-DUTY VALVES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section summarizes the design criteria for valves used in plumbing and HVAC systems. Valve requirements for steam, steam condensate, condenser water, chilled water, heating hot water, glycol, and fuel oil services are shown in Tables 1 through 8.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General

Cast or stamp the name of the manufacturer and guaranteed working pressure on the valve bodies.

Valves of a similar type must be by a single manufacturer.

Provide chain operators for valves 3" and larger that are installed 7' or more above floor.

Gaskets and packings must not contain asbestos.

Ratings must include ANSI class rating and hole pattern for flanges.

All steam system valves in steam and condensate piping must be gate or globe valves.

Butterfly Valves

Provide lug-style butterfly valves as shown in Tables 1 through 8. When required by the manufacturer, install valves in the proper direction for shutoff and dead-end service.

General service valves must be ductile iron body and threaded-lug, with resilient EPDM seats, stainless steel disks, and 416 stainless stems.

Valves 6" and larger must have gear operators.

Valves smaller than 6" must have seven-position levers.

If valves are used for fuel oil, provide reinforced Teflon seats and 316 stainless disks.

For chilled water systems, select high-performance butterfly valves for isolation and shutoff applications on mains and branches over 4” in diameter.

Ball valves

Hot water systems should incorporate ball valves for isolation purposes.

Ball valves may be used on chilled water lines that are 4" in diameter and smaller. The pressure rating must be per ANSI standard.

Provide full-port, two-piece ball valves with reinforced Teflon scats, seals, bearings, stainless steel balls, and packing.

Select 1-1/4" ball valves for drains.

Valves on insulated piping must have 2" extended stems.

All ball valves must have locking handles to allow servicing and removal of equipment.

Globe Valves

Provide globe valves as shown in Tables 1 through 8.

Refrigerant valves must be back-seating, globe stop valves, winged and sealed. 1" and under cap valves must have diaphragm packing.

Plug Valves

Provide plug valves with 70 percent port openings for balancing.

Provide gear operators with memory indicators.

Check Valves

Use silent and lift checks for heating hot water and chilled water systems.

Use swing checks for steam systems.

Spring-Loaded Relief Valves

Reliefs must be ASME-approved.

For water reliefs, pipe the discharge into an indirect drain. Where permitted by the building code, pipe chiller refrigerant and steam relief devices through the building envelope.

Gate Valves

Steam systems should incorporate gate valves for isolation purposes.

Provide gate valves as shown in Tables 1 through 8.

Gate valves may be used on 4" and smaller chilled water lines. The pressure rating must be per ANSI standard.

Select 1", full-port gate valves for vents.

In general, gate valves must have OS&Y rising stems to indicate position. For restricted clearances, gate valves must have non-rising stems. The contractor must submit the location where each type of gate valve is used.

Serrated-Tip Laboratory Faucets

For use on laboratory faucets, serrated- tip laboratory faucets must have vacuum breakers.

Reference Tables

Table 1. Steam and Condensate Service

Steam and Condensate Service Maximum 90 psig Saturated Steam						
Specialty	Application	Type	Size	Body/Seat Body/Trim	Connection	Minimum Rating1-2
Ball valve	Not used					
Gate valve	Isolation	OS&Y	2-1/2-36"	Iron/Bronze Iron/Iron	Flanged	Class 125
Globe valve	Manual steam modulation only	Union Bonnet	1/2"-2"	Bronze/Stainless Bronze/Bronze	Threaded	125 psig SWP
		OS&Y	2-1/2--10"	Iron/Bronze	Flanged	Class 125
Butterfly valve	Not used					
Plug valve	Not used					
Check valve	Steam and condensate horizontal flow	Non Y-type swing check valve (15° angle)	1/2"-2"	Bronze/Teflon	Threaded (Use dielectrics for condensate)	125 psig WSP
			2-1/2-30"	Iron/Iron	Flanged	Class 125
Strainer	Control valves and flow meters and steam traps	Y-Type	1/2"-2"	Iron/Stainless (1/16" diameter)	Threaded	Class 125
			2-1/2-10"	Iron/Stainless (3/64" diameter)	Flanged	Class 125
			12"-24"	Iron/Stainless (1/16" diameter)	Flanged	Class 125
Vacuum breaker	Steam coils and HX and condensate trap legs	Steam vacuum breaker	1/2"-2"	Bronze/Teflon	Threaded (Use dielectrics for condensate)	Class 125

These are minimum ratings. For actual maximum allowable valve and strainer ratings, refer to the documents listed under References.

SWP = Steam Working Pressure WOG = Water, Oil, or Gas WSP = Working Steam Pressure Class =ANSI Standard

Table 2. Steam and Condensate Service

Steam and Condensate Service Maximum 200 psig Saturated Steam						
Specialty	Application	Type	Size	Body/Seat Body/Trim	Connection.	Minimum Rating 1,2
Ball valve						
Gate valve	Isolation	OS&Y	2-1/2"-36"	Iron/Bronze Iron/Iron	Flanged	Class 250
Globe valve	Manual steam modulation only	Union Bonnet	1/2"-2"	Bronze/Stainless Bronze/Bronze	Threaded	250 psig SWP
		OS&Y	2-1/2"-10M	Iron/Bronze	Flanged	Class 250
Butterfly valve	Not used					
Plug valve	Not used					
Check valve	Steam and condensate horizontal flow	NonY-Type swing check valve (15° angle)	1/2M-2"	Bronze/Teflon	Threaded (Use dielectrics for condensate)	250 psig WSP
			2-1/2"-30"	Iron/Iron	Flanged	Class 250
Strainer	Control valves and flow meters and steam traps	Y-Type	1/2"-2"	Iron/Stainless (1/16" diameter)	Threaded	Class 250
			2-1/2"-10"	Iron/Stainless (3/64" diameter)	Flanged	Class 250
			12"-24"	Iron/Stainless (1/16" diameter)	Flanged	Class 250
Vacuum breaker	Steam coils and HX and condensate trap legs	Steam vacuum breaker	1/2"-2"	Bronze/Teflon	Threaded (Use dielectrics for condensate)	Class 250

These are minimum ratings. For actual maximum allowable valve and strainer ratings, refer to the documents listed under References.

SWP = Steam Working Pressure WOG = Water, Oil, or Gas WSP = Working Steam Pressure Class =ANSI Standard

UNLV PLANNING & CONSTRUCTION

Technical Design Guidelines

Table 3. Steam and Condensate Service

Steam and Condensate Service Maximum 200 psig Saturated Steam						
Specialty	Application	Type	Size	Body/Seat Body/Trim	Connection.	Minimum Rating1,2
Ball valve						
Gate valve	Isolation	OS&Y	2-1/2"-36"	Iron/Bronze Iron/Iron	Flanged	Class 250
Globe valve	Manual steam modulation	Union Bonnet	1/2"-2"	Bronze/Stainless Bronze/Bronze	Threaded	250 psig SWP
		OS&Y	2-1/2"-10"	Iron/Bronze	Flanged	Class 250
Butterfly valve	Not used					
Plug valve	Not used					
Check valve	Steam and condensate horizontal flow	NonY-Type swing check valve (15° angle)	1/2"-2"	Bronze/Teflon	Threaded (Use dielectrics for condensate)	250 psig WSP
			2-1/2-30"	Iron/Iron	Flanged	Class 250
Strainer	Control valves and flow meters and steam traps	Y-Type	1/2"-2"	Iron/Stainless (1/16" diameter)	Threaded	Class 250
			2-1/2"-10"	Iron/Stainless (3/64" diameter)	Flanged	Class 250
			12"-24"	Iron/Stainless (1/16" diameter)	Flanged	Class 250
Vacuum breaker	Steam coils and HX and condensate trap legs	Steam vacuum breaker	1/2"-2"	Bronze/Teflon	Threaded (Use dielectrics for condensate)	Class 250

These are minimum ratings. For actual maximum allowable valve and strainer ratings, refer to the documents listed under References.

SWP = Steam Working Pressure WOG = Water, Oil, or Gas WSP = Working Steam Pressure Class =ANSI Standard

Table 4. Glycol, Chilled, and Condenser Water Service

Glycol, Chilled arid Condenser Water Service Maximum 150°F and 150 psig (1/2B-12")/125 psig (14"-24M)						
Specialty	Application	Type	Size	Body/Seat Body/Trim	Connection	Minimum Rating1,2
Ball valve	Isolation	Full port 2-pc.	1/2"-2"	Bronze/Teflon	Sweat'	400 psig WOG
		Full Port 2-pc.	1/2"-2"	Bronze/Teflon	Threaded	400 psig WOG
Gate valve	Not Used					
Globe valve	ATC modulation	Control valve	1/2"-2"	Bronze/Metal	Threaded	400 psig WOG
Butterfly valve	Isolation	General service	2 1/2"-12"	Ductile iron/EPDM	Threaded Lug	175 psig CWP 150 psig bi-directional shutoff 150 psig dead-end service
		General service	14"-24"	Ductile iron/EPDM	Threaded Lug	150 psig CWP 150 psig bi-directional shutoff 150 psig dead-end service
Plug value	Throttling	Non-lubricated	3-12"	Steel/Iron	Flanged	Class 125
Check valve	Pumps	Silent	1/2n-2"	Bronze/Bronze	Threaded	200 psig WOG
		Silent globe	2-1/2"-24"	Iron/Bronze	Flanged	Class 125
	Piping	Y-Pattern swing	1/2"-2"	Bronze/Bronze	Threaded	200 psig WOG
			2-1/2"-24"	Iron/Bronze	Flanged	Class 125
Strainer	Control valves and flow meters	Y-Type	1/2"-2"	Bronze/Stainless (1/16" diameter)	Threaded	200 psig WOG
			2-1/2--4"	Iron/Stainless (1/16" diameter)	Flanged	Class 125
			5"-24"	Iron/Stainless (1/8" diameter)	Flanged	Class 125

Table 4. Glycol, Chilled, and Condenser Water Service—Continued

Glycol, Chilled and Condenser Water Service Maximum 150°F and 150 psig (1/2"-12")/125 psig {14M-24")						
Specialty	Application	Type	Size	Body/Seat Body/Trim	Connection	Minimum Rating1,2
Strainer	Pump suction	In-line Y-Type	1/2"-2"	Bronze/Stainless (1/16" diameter)	Threaded	200 psig WOG
			2-1/2"-4"	Iron/Stainless (3/16" diameter)3	Flanged	Class 125
			5"-24"	Iron/Stainless (3" diameter)3	Flanged	Class 125
		Angle suction diffuser end suction pumps	2"-12"	Iron/Stainless (3/16" diameter)3 Startup strainer = 16 mesh bronze	Flanged	Class 125

These are minimum ratings for ASTM A126, Class B and ASTM B-61 and 62. For higher pressures and temperatures, adjust these values to include static head plus 1.1 times pressure relief valve setting plus pump shut off T head pressure. For actual maximum allowable valve and strainer ratings, refer to "Pressure-Temperature Ratings • Non Shock" tables and "Adjusted Pressure Ratings" for copper tube, soldered end valves and strainers.
SWP= Steam Working Pressure
CWP= Cold Water Working Pressure
WSP= Working Steam Pressure
WOG= Water, Oil, or Gas
Class= ANSI Standard
Use 1/8” diameter for plate heat exchanger application.

Table 5. Glycol, Chilled, and Condenser Water Service

Glycol, Chilled and Condenser Water Service Maximum 150°F and 275 psig (1/2"- 24”)						
Specialty	Application	Type	Size	Body/Seat Body/Trim	Connection	Minimum Rating1,2
Ball valve	Isolation	Full port 2-pc.	1/2"-2"	Bronze/Teflon	Threaded	600 psig WOG
Gate valve	Not used					
Globe valve	ATC modulation	Control valve	1/2"-2"	Bronze/Metal	Threaded	600 psig WOG
Butterfly valve	Isolation	High performance	2-1/2"-24"	Carbon steel/ PTFE	Threaded lug	285 psig CWP
Plug value	Throttling	Non-lubricated	3"-12"	Steel/Iron	Flanged	Class 300
Check valve	Pumps	Silent	1"-2"	Bronze/Bronze	Threaded	Class 300
		Silent globe	2-1/2"-24"	Iron/Bronze	Flanged	Class 250
	Piping	Y-Pattern swing	1/2"-2"	Bronze/Bronze	Threaded	Class 300
			2-1/2"-24"	Iron/Bronze	Flanged	Class 250
Strainer	Control valves and flow meters	Y-Type	1/2"-2"	Bronze/Stainless (1/16" diameter)	Threaded	Class 250
			2-1/2"-4"	Iron/Stainless (1/16" diameter)	Flanged	Class 250
			5"-24"	Iron/Stainless (1/8" diameter)	Flanged	Class 250
	Pump suction	In-line Y-Type	1/2"-2"	Iron/Stainless (1/16" diameter)	Threaded	Class 250
			2-1/2"-4"	Iron/Stainless (3/16" diameter)3	Flanged	Class 250
			5-24"	Iron/Stainless (3" diameter)3	Flanged	Class 250

Table 5. Glycol, Chilled, and Condenser Water Service—Continued

	Glycol, Chilled and Condenser Water Service Maximum 150°F and 275 psig (1/2"-24")					
Specialty	Application	Type	Size	Body/Seat Body/Trim	Connection	Minimum Rating1,2
Strainer	Pump suction	Angle suction diffuser end suction pumps	2"-12"	Iron/Stainless (3/16" diameter)3 Startup strainer = 16 mesh bronze	Flanged	Class 250

These are minimum ratings. For higher pressures and temperatures, adjusi these values to include static head plus 1.1 times pressure relief valve setting plus pump shulofThead pressure. For actual maximum allowable valve and strainer ratings, refer to "Pressure-Temperature Ratings - Non Shock" tables.
SWP = Steam Working Pressure
CWP = Cold Water Working Pressure
WSP = Working Steam Pressure
WOG = Water, Oil or Gas
Class = ANSI Standard
Use 1/8” diameter for plate heat exchanger application.

Table 6. Hot Water Service

Hot Water Service Maximum 250°F and 175 psig (1/2”-12”)/125 psig (14"-24”)						
Specialty	Application	Type	Size	Body/Seat Body/Trim	Connection.	Minimum Rating1'2
Ball valve	Isolation	Full port 2-pc.	1/2-2"	Bronze/Teflon	Sweat1	400 psig WOG
		Full port 2-pc.	1/2"-2"	Bronze/Teflon	Threaded	400 psig WOG
Gate valve	Not used					
Globe valve	ATC modulation	Control valve	1/2"-2"	Bronze/Metal	Threaded	400 psig WOG
Butterfly valve	Isolation	General service	2-1/2"-12"	Ductile Iron/EPDM	Threaded lug	200 psig CWP 200 psig bi-directional shutoff 200 psig dead end service
			14-24"	Ductile Iron/EPDM	Threaded lug	150 psig CWP 150 psig bi-directional shutoff 150 psig dead end service
Plug value	Throttling	Non-lubricated	3"-12"	Steel/Iron	Flanged	Class 125
Check valve	Pumps	Silent	1/2"-2"	Bronze/Bronze	Threaded	200 psig WOG
		Silent globe	2-1/2"-24"	Iron/Bronze	Flanged	Class 125
	Piping	Y-Pattern swing	1/2"-2"	Bronze/Bronze	Threaded	200 psig WOG
			2-1/2"-24"	Iron/Bronze	Flanged	Class 125
Strainer	Control valves and flow meters	Y-Type	1/2"-2"	Bronze/Stainless (1/16" diameter)	Threaded	200 psig WOG
			2-1/2"-4"	Iron/Stainless (1/16" diameter)	Flanged	Class 125
			5"-24"	Iron/Stainless (1/8" diameter)	Flanged	Class 125
	Pump suction	In-line Y-Type	1/2"-2"	Bronze/Stainless (1/16" diameter)	Threaded	200 psig WOG

Table 6. Hot Water Service—Continued

Hot Water Service Maximum 250°F and 175 psig (1/2”-12”)/125 psig (14"-24”)						
Specialty	Application	Type	Size	Body/Seat Body/Trim	Connection	Minimum Rating1,2
Strainer	Pump suction	In-line Y-Type	2-1/2"-4"	Iron/Stainless (3/16" diameter)3	Flanged	Class 125
			5"-24"	Iron/Stainless (3" diameter)3	Flanged	Class 125
		Angle suction diffuser end suction pumps	2"-12"	Iron/Stainless (3/16" diameter)3 Startup strainer = 16 mesh bronze	Flanged	Class 125

These are minimum ratings for ASTM A126, ClassB and ASTM B-61 and 62. For higher pressures and temperatures, adjust these values to include static head plus I. I times pressure relief valve setting plus pump shutoff head pressure. For actual maximum allowable valve and strainer ratings, refer to "Pressure-Temperature Ratings • Non Shock" tables and "Adjusted Pressure Ratings" for copper tube, soldered end valves [and strainers].
SWP = Steam Working Pressure
CWP = Cold Water Working Pressure
WSP = Working Steam Pressure
WOG = Water, Oil or Gas
Class = ANSI Standard
Use 1/8” diameter for plate heat exchanger application.

Table 7. Hot Water Service

Hot Water Service Maximum 250°F and 400 psig (1/2"-12")/250 psig (14"-24")						
Specialty	Application	Type	Size	Body/Seat Body/Trim	Connection	Minimum Rating1,2
Ball valve	Isolation	Full port 2-pc.	1/2"-2"	Bronze/Teflon	Sweat1	Do not use
		Full port 2-pc.	1/2"-2"	Bronze/Teflon	Threaded	600 psig WOG
Gate valve	Not used					
Globe valve	ATC modulation	Control valve	1/2"-2"	Bronze/Metal	Threaded	600 psig WOG
Butterfly valve	Isolation	High performance	2-1/2"-24"	Carbon steel/PTFE	Threaded lug	740 psig CWP
Plug value	Throttling	Non-lubricated	3-12"	Steel/Iron	Flanged	Class 250
Check valve	Pumps	Silent	T-2"	Bronze/Bronze	Threaded	Class 250
		Silent globe	2-1/2"-24"	Iron/Bronze	Flanged	Class 250
	Piping	Y-Pattern swing	1"-2"	Bronze/Bronze	Threaded	Class 250
			2-1/2"-24"	Iron/Bronze	Flanged	Class 250
Strainer	Control valves and flow meters	Y-Type	1/2"-2"	Bronze/Stainless (20 mesh)	Threaded	600 psig WOG
			2 1/2"-4"	Iron/Stainless (1/16" diameter)	Flanged	Class 250
			5"-24"	Iron/Stainless (1/8" diameter)	Flanged	Class 250
	Pump suction	In-line Y-Type	1/2"-2"	Bronze/Stainless (1/16" diameter)	Threaded	600 psig WOG
			2-1/2"-4"	Iron/Stainless (3/16" diameter)3	Flanged	Class 250
			5"-24"	Iron/Stainless (3" diameter)3	Flanged	Class 250

Table 7. Hot Water Service—Continued

	Hot Water Service Maximum 250°F and 400 psig (1/2M-12")<250 psig (14"-24")					
Specialty	Application	Type	Size	Body/Seat Body/Trim	Connection	Minimum Rating1,2
Strainer	Pump suction	Angle suction diffuser end suction pumps	2"-12"	Iron/Stainless (3/16" diameter)3 Startup strainer = 16 mesh bronze	Flanged	Class 250

These are minimum ratings for ASTM A126, Class Band ASTM B-61 and 62. For higher pressures and temperatures, adjust these values to include static head plus 1.1 times pressure relief valve setting plus pump shutoff head pressure. For actual maximum allowable valve and strainer ratings, refer to "Pressure-Temperature Ratings - Non Shock" tables and "Adjusted Pressure Ratings" for copper tube, soldered end valves (and strainers].
SWP = Steam Working Pressure
CWP = Cold Water Working Pressure
WSP = Working Steam Pressure
WOG = Water, Oil or Gas
Class = ANSI Standard
Use 1/8" diameter for plate heat exchanger application.

Table 8. Hot Water Service

Fuel Oil Service Maximum 150°F arid 150 psig (1/2"-12")/125 psig (14"-24")						
Specialty	Application	Type	Size	Body/Seat Body/Trim	Connection	Minimum Rating1,2
Ball valve	Isolation	Full port 3-pc.	1/2H-2"	Carbon steel/PTFE	Threaded	250 psig WSP
Gate valve	Isolation		1/2"-2"	Bronze/Metal	Threaded	Class 125
Globe valve	ATC modulation	Control valve	1/2"-2"	Bronze/Metal	Threaded	400 psig WOG
Butterfly valve	Not used					
Plug value	Throttling	Non-lubricated	3-12"	Steel/Iron	Flanged	Class 125
Check valve	Piping	Y-Pattern swing	1/2"-2"	Bronze/Bronze	Threaded	200 psig WOG
			2-1/2-24"	Iron/Bronze	Flanged	Class 125
Strainer	Control valves and flow meters	Y-Type	1/2"-2"	Bronze/Stainless (1/16" diameter)	Threaded	200 psig WOG
			2-1/2"-4"	Iron/Stainless (1/16" diameter)	Flanged	Class 125
			5"-24"	Iron/Stainless (1/8" diameter)	Flanged	Class 125
	Pump suction	In-line Y-Type	1/2"-2"	Bronze/Stainless (1/16" diameter)	Threaded	200 psig WOG
			2-1/2"-4"	Iron/Stainless (3/16" diameter)	Flanged	Class 125
			5-24"	Iron/Stainless (3" diameter)	Flanged	Class 125

Table 8. Hot Water Service—Continued

Fuel Oil Service Maximum 150°F and 150 psig (1/2W-12M)/125 psig (14"-24")						
Specialty	Application	Type	Size	Body/Seat Body/Trim	Connection	Minimum Rating1,2
Strainer	Pump suction	Angle suction diffuser end suction pumps	2"-12"	Iron/Stainless (3/16" diameter) Startup strainer = 16 mesh bronze	Flanged	Class 125

These are minimum ratings for ASTM Al 26, Class B and ASTM B-61 and 62. For higher pressures and temperatures, adjust these values to include static head plus I. I limes pressure relief valve setting plus pump shutoff head pressure. For actual maximum allowable valve and strainer ratings, refer to "Pressure-Temperature Ratings - Non Shock" tables.
SWP = Steam Working Pressure
CWP = Cold Water Working Pressure
WSP = Working Steam Pressure
WOG = Water, Oil or Gas
Class = ANSI Standard
Use 1/8” diameter for plate heat exchanger application.

Manufacturers

Subject to compliance with the design requirements, provide products by one of the following manufacturers:
Butterfly Valves
2" to 12" lug valves:
- Jamesbury
- Milwaukee
- Hills-McCanna
- Dezurick

2" to 12" wafer valves:
- Jamesbury
- Milwaukee
- Dezurik
- Hills-McCanna

Threaded and Soldered Ball Valves:
- Stockham, B-22T series
- Milwaukee
- Apollo
- Walworth
- Lunkenheimcr

Globe Valves
2" threaded and soldered valves:
- Stockham, B-22Tseries
- Milwaukee
- Apollo
- Walworth
- Lunkenheimcr

- Hammond

2" to 12" flanged valves:

- Stockham, B-22T series
- Milwaukee
- Apollo
- Walworth
- Lunkenheimer
- Hammond
- Plug Valves
- DeZurik
- Carol Test
- KyroTest

Check Valves"

Check swing 2" threaded and soldered valves:

- Stockham, B-22T series
- Milwaukee
- Walworth
- Lunkenheimer
- Hammond

Check swing 2" to 12" flanged valves:

- Stockham, B-22T series
- Milwaukee
- Nibco
- Apollo
- Walworth
- Lunkenheimer
- Hammond

Check lift 2" threaded and soldered valves:

- Stockham, B-22T series
- Milwaukee
- Nibco
- Walworth
- Lunkenheimer
- Hammond

Gate Valves

2" threaded, soldered, and flanged valves:

- Stockham, B-100 series
- Milwaukee
- Apollo
- Hammond

21/2 to 12" flanged valves:

- Stockham, B-100 series
- Milwaukee
- Apollo
- Walworth
- Lunkenheimer
- Hammond

Laboratory Faucet Vacuum Breakers:

- Nidel 3/8" (double-tight inline)
- T&S BL-5550-8.2 (double-tight inline)

Steam Heat Exchanger Vacuum Breakers:

- Hoffman

- Steam Valves
- Jenkins
- Stockham
- Lunkenheimer

Circuit Setters:
- Armstrong
- Bell&Gossett
- Griswold
- Tour Anderson
- Walworth
- Lunkenheimer

Balancing Valves:
- Armstrong
- Bell & Gossett
- Griswold
- Tour Anderson
- Triple Duty Valves

MATERIALS

Combination balancing shut-off valves must be of bronze body or brass ball construction with glass and carbon-filled TFE seat rings. The valves must have differential pressure readout ports across the valve seat area. Readout ports must be fitted with internal EPT inserts and check valves. The valves must have memory stops to allow them to be closed for service, then reopened to setpoint without disturbing the balancing position. Balancing valves cannot be used for isolation valves.

INSTALLATION GUIDELINES

Distilled Water Systems
Avoid the use of snap-action valves and/or faucets.

Circuit Setters and Valves

Circuit setters arc required in the supply and return of heating hot water and-chilled water coils.

Valves are inexpensive compared to the function they perform. Provide a sufficient number of valves to isolate equipment for maintenance purposes by showing a. valve between each piece of equipment on a loop or header.

Install isolation valves on both sides of control valves and coils, and on the entering and leaving sides of equipment.

Provide adequate balancing valves to facilitate and verify reliable test and balance.

Back-Water Valves
When the potential for flooding exists, special attention to details (including the use of back-water valves) is required at basement and area drain installations.

Back-water valves are not totally satisfactory, and their use should be limited to storm lines. A more satisfactory installation is the use of sump pumps and sewage ejectors.

Vacuum breakers
Equip water faucets having provisions for hose attachments with vacuum breaker back-flow preventers. Note that serrated-tip laboratory faucets are included in this category.

Type (when available): Integral; (otherwise) vandal-proof spout-end.

Angle should not be used on faucets because of spillage onto sink tops.

SECTION 15123

EXPANSION FITTINGS AND LOOPS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

Expansion fittings or engineered expansion loops shall be provided on all hot water piping runs greater the 150 feet in length.

SECTION 15126

METERS AND GAUGES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for meters and gauges.

Flow meters, turbine shall be provided in condenser, chilled, and heating hot water systems. Meters shall be Oinicon turbine for closed loops and Onicon Acoustical for the condenser loop.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Pressure gauges must be bronze Bourdon tube-type, accurate to ±l percent.

Pressure gauges must be easily accessible and easily read. Gauges readable from the floor at less than 5' must have 4-1/2" dials. Other gauges must have 6" dials. Gauge graduations must meet the limit requirements of normal operation. Gauges must indicate at mid-scale.

Thermometers must have a 9" scale and white face with black-filled engraved letters. Thermometers must be angular or straight-stemmed, as conditions necessitate.

Combination pressure and temperature (P/T) test plugs must bel/4" or 112" NPT. Plugs must be rated at zero leakage from vacuum to 1000 psig.

Manufacturers

Subject to compliance with the design requirements, provide products by one of the following manufacturers:
Pressure gauges
- U.S. Gauge
- Trerice
- Ashcroft

Thermometers
- U.S. Gauge
- Trerice
- Ashcroft

Combination pressure and temperature (P/T) test plugs
Peter Equipment Company "Petes Plug"
Sisco, Inc. “P/T Plugs”

MATERIALS

Thermometer wells must be bronze.

Combination pressure and temperature (P/T) test plugs must be constructed of solid brass with a Nordel valve core suitable for temperatures up to 350°F.

Gauges must have white faces with black-filled, engraved lettering. Gauge bodies must be set in phenolic cases. Provide siphons and shut-off cocks.

Accessories or Special Features
Provide combination pressure and temperature (P/T) test plugs with extension plug suitable for use with 2" maximum pipe insulation.

INSTALLATION GUIDELINES

Install thermometer wells to ensure the minimum restriction of water flow in the pipe.

Provide access for reading gauges.

To facilitate performance verification and for on-going operation and maintenance, provide sufficient temperature and pressure gauges and flow meters beyond that necessary to control the systems.

Provide pressure and temperature (P/T) test plugs close to the controlling sensors for verifying their calibration.

SECTION 15140

DOMESTIC WATER PIPING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for domestic water systems piping within a facility.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

The maximum water velocity in piping must not exceed 5 feet per second.

Provide water shock absorbers at all flush valves and other locations where sudden valve closures would cause water hammer. Do not use capped air columns, which become water logged after a period of time.

The maximum static water pressure at fixtures must be 75 psig. Provide pressure reducing valves where static pressure exceeds 75 psig.

For large plan spaces, such as laboratories, consider a looped piping system to facilitate changes to the system and provide redundancy of feed and constant pressure to all areas.

Provide adequate expansion loops and anchors.

Be sure building service connections coordinate with the HVAC equipment.

Provide freeze protection for exterior water lines, such as cooling tower feeds.

Install hose bibs in all machinery rooms, kitchens, and in all rooms containing floor drains but no water-supplied fixtures.

Provide trap primers at all floor drains and floor sinks.

Faucets and urinal flush valves shall be battery operated and useable for Handicapped.

Flush valves for water closets shall be the two-flush Sloan or equal.

Exposed plumbing drains, clean outs, shall be satin finished bronze, and all shall be square or rectangular, and only in carpeted areas may the shape be round.

SUBMITTALS

Submit the following design and construction documentation.

Designer Submittals
Submit domestic water load and non-potable load calculations with sketch.

Construction Documents
Submit pipe cleaning and pipe pressure test reports.

MANUFACTURERS

Subject to compliance with the design requirements

MATERIALS

All interior copper water piping above grade must be Type L seamless only.

Domestic Cold Water
Maximum operating limits: 100 psig, 250°F maximum temperature: copper

Domestic Hot Water
Maximum operating limits: 100 psig, 250°F maximum temperature: copper

Domestic Hot Return
Maximum operating limits: 100 psig, 250°F maximum temperature: copper

Non-Potable Water
Maximum operating limits: 100 psig, 250°F maximum temperature: copper

INSTALLATION GUIDELINES

Install a control valve on each piping riser branch take-off.

Install drain valves with 3/4" hose connections and caps at all low points in the system. Each hose bibb must have and integral vacuum breaker.

Ensure that water piping pitches up in the direction of flow.

To prevent transmitting vibrations through the piping system, install flexible connections on piping connected to vibrating equipment.

Do not install plumbing piping in transformer vaults, switchboard rooms, data centers or telephone rooms, or electrical rooms.

Install frost-proof hose bibs every 100 ft around the building, on the roof for washing down air handling unit coils, and in mechanical rooms.

SECTION 15150

SANITARY OR LABORATORY WASTE AND VENT PIPING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for sanitary, laboratory waste, and vent systems piping within a facility.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Where noise is a consideration, use cast iron drain lines for sanitary drainage. Only cast iron shall be installed within the building.

The lab waste drainage and vent piping system must be separate from the domestic sanitary waste and vent system until after lab waste neutralization system tanks. Laboratory wastes and animal cage washroom floor drains must pass through the neutralization system.

All condensate from air conditioning equipment and other HVAC drains, including cooling tower overflow and drain, must go to the sanitary sewer system.

There must be no direct connection between air conditioning equipment drain piping and the sanitary plumbing system.

Drains from air conditioning equipment must terminate, with an air gap, above the flood level rim of a plumbing fixture, such as a floor drain, floor sink, sink, or open-sight drain.

Open-sight drains, if used, must not be in concealed spaces. Provide trap primers for drains.

The following requirements apply to the condensate drains from cooling coils and to the drains from sections of air conditioning units and plenums.

All fan coils must have condensate drain lines, even if designed for sensible cooling only. Provide a sufficient number of unit drain risers to permit a slope in the horizontal drain lines of at least one inch per 40 feet. The minimum horizontal drain must be 3/4 inches in diameter. As a general rule, the maximum horizontal run must be 40 feet.

Condensate drainage directly through the wall to the ground is not permitted per code.

SUBMITTALS

Submit the following design and construction documentation.

Designer Submittals
Submit sanitary and laboratory fixture count calculations with sketch.

Construction Documents
Submit pipe cleaning and pipe pressure test reports.

MATERIALS

Use PVDF for all lab-waste and vent within plenums (25/50 rating).

Sanitary Waste and Vent Piping
Gravity flow, 120°F maximum temperature, cast iron pipe.

Force Main
Maximum operating limits: 50 psig, galvanized steel.

Lab Vent Piping
Gravity flow, 100°F maximum temperature, polypropylene.

Lab Waste Piping
Gravity flow, 120°F maximum temperature, polypropylene.

Lab Waste Forced Main
150 psig, 120°F maximum temperature, polypropylene.

INSTALLATION GUIDELINES

Maintain air gaps, as required by code, where indirect waste discharges into traps or funnel drains.

Provide floor drains with trap primers at the following locations:

At fire protection riser alarm valves and at test-and-drain valves when not discharged through a wall, a floor sink is required.

At pumps, refrigeration compressors, air compressors, vacuum pumps, boilers, water heaters, air conditioning equipment, water softeners, and other locations as required.

In kitchens near dishwashers, steam kettles, large refrigerators, and at other locations as required.

SECTION 15160

STORM DRAINAGE PIPING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for storm drainage system piping within a facility.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

1/4 per linear foot slope (minimum).

Where slope is not feasible, locate drains below the adjacent roof surface near the center of structural framing bays, but not near columns, girders, and intersections with vertical surfaces. Drain size must be 3" IPS (minimum), with strainer.

When the roof area is surrounded by parapet walls, provide emergency overflow scupper drains, as required by code, in addition to interior drains. The bottom of the scupper, if used, must be above the top of the cant strip (or 4" above the top of the roof surface at the drain).

Use the latest code for 1.5" rainfall per hour for a 1 -hour duration and a 100-year return period. Follow the UPC Table.

SUBMITTALS

Submit the following design and construction documentation.

Designer Submittals
Submit storm roof drain sizing calculations with sketch.

Construction Documents
Submit pipe cleaning and pipe pressure test reports.

MATERIALS

Use cast iron drain lines where noise is a consideration. Only cast iron piping shall be used within the building.

Storm drain: gravity flow, 80°F maximum temperature, cast iron pipe.

INSTALLATION GUIDELINES

Take below-grade clear water drains to a sump pit. Use duplex sump pumps to

pump the water into the gravity house drain.

Take footing drains through a sediment interceptor before connecting them to a sump pit.

SECTION 15181

HYDRONIC PIPING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for hydronic heating and cooling system piping and specialties within a facility.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Air Vents

All closed hydronic systems shall have an automatic air venting valve, located at a high point in the system, at the top of coils, and plate-frame exchangers. The air vent is to ensure complete bleed-off of air trapped in the closed system. The air vent shall be a self closing type that closes when the pumps are off, and shall contain an inline shut-off valve or pet-cock. A drain pipe shall be installed to ensure proper drainage, clear of the insulation.

Every closed loop hydronic system shall include the installation of an air separator, expansion tank, and make up water connection at the pump suction.

Design piping, hangers, and braces for seismic zone C-per IBC. The hanger supplier is not responsible for seismic design. The engineer is responsible for the design of anchors, thrust restraints, guides, and similar components.

Include pipe marking requirements in the project specifications. See Section 15076, Mechanical Identification. Underground systems design must include buried identification and warning tape for damage prevention.

Underground systems design requires an evaluation of cathodic protection. If needed, the engineer will design these systems, not the vendor.

Leak detection is generally not required on underground chilled water systems.

For large plan spaces, such as laboratories, consider a looped piping system to facilitate changes to the system and provide redundancy of feed and constant pressure to all areas.

Provide adequate expansion loops and anchors.

Water velocity and pressure drop limits.

Water velocity over occupied spaces

4 fps is the maximum water velocity for 2" and smaller piping.

8 fps is the maximum water velocity for 2-1/2" and larger piping to minimize water noise.

Water velocity over equipment or unoccupied spaces.

4 fps is the maximum water velocity for 2" and smaller piping.

8 fps is the maximum velocity for 2-1/2" and larger piping.

Minimum velocity and pressure drop for air removal.

1.5 to 2 fps is the minimum velocity for 2" and smaller piping.

0.75 ft/100 ft is the minimum pressure drop for 2-1/2" and up piping.

The maximum pressure drop is 4 ft/100 ft.

SUBMITTALS

Submit the following design and construction documentation.

Designer Submittals
Submit heating and cooling load calculations, with sketch, for heating hot water, chilled water, and condenser water systems.

Construction Documents
Submit pipe cleaning and pipe pressure test reports.

MANUFACTURERS

Subject to compliance with the design requirements, provide products by one of the following manufacturers:

Watts Fluid Strainers

Strainers, Y-type or basket:
- Elliot
- Sarco
- Zum
- Mueller
- Huffman

Thermostatic radiator valves:
- Honeywell Brachmann
- Macon

MATERIALS

Chilled Water Piping
Pipe and fittings must be manufactured in the USA. System selection is project-specific. The following underground piping systems are acceptable:
- Welded steel pipe in tunnel or half tunnel.
- Direct-buried, cement-lined ductile iron.
- Welded steel pipe in insulated FRP conduit, pre-insulated.

INSTALLATION GUIDELINES

Piping design must include drains at low points and vents at high points.

Install a control valve on each piping riser.

Install a drain valve with a 3/4" hose connection, cap and vacuum breaker at all low points in the system.

Ensure that water piping pitches up in the direction of flow.

Piping connected to vibrating equipment must have flexible connections to prevent transmitting vibrations through the piping system.

Do not install piping in transformer vaults, switchboard rooms, data centers, or telephone rooms, or electrical rooms per NEC.

Quality Control Testing

Specify weld inspection and testing that is appropriate for the project.

Specify hydrostatic testing at 150 percent of the design pressure. Testing at 150 percent of the working pressure is not acceptable.

Cleaning and Adjusting

All new hydronic water pipe shall be initially cleaned before start-up of any equipment with San Joaquin Chemicals, Inc. Sanasolv 8103 or equal.

Water treatment specialists shall be Chem Aqua. All new water treatment chemicals shall be approved by UNLV prior to its introduction to the system.

Cleaning

All hydronic systems shall be flushed and cleaned with an approved cleaner prior to issuance of substantial completion. Representatives of the UNLV Office of Planning shall approve the cleaner and witness the process. The flushing and cleaning process shall be performed to the satisfaction of the UNLV representative witnessing the process. The contractor shall retest the hydronic media two weeks after the installation of the water-treatment chemicals or products to determine if that procedure has dislodged any debris, dirt, etc. not observed during the preceding tests. If the turbidity has increased, the contractor shall at his cost reclean the system, and retest every two weeks thereafter until no change in turbidity is observed by the UNLV Planning and Construction representative.

Refer to section 15545- Chemical Water Treatment.

SECTION 15183

REFRIGERANT PIPING AND SPECIALTIES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for refrigerant piping and piping specialties.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

All piping shall be copper tubing, unless approved otherwise by UNLV Planning and Construction.

Provide pipe hangers and supports in accordance with ASTM unless indicated otherwise.

Refrigerant:
- ASHRAE 34

Liquid Indicators:
Use line size liquid indicators in main liquid line leaving condenser.
- Refrigerant Charging (Packed Angle) Valve: Use in liquid line between shut-off valve and expansion valve.

Strainers:
- Use line size strainer upstream of each automatic valve.

Permanent Filter-Driers:
- Use in low temperature systems.

Receivers:
- Use on systems five tons and larger, sized to accommodate pump down charge.
- Use on systems with long piping runs.

Flexible Connectors:
- Utilize at or near compressors where piping configuration does not absorb vibration.

Valves:
- Provide diaphragm packless valves; packed angle valves; ball valves and/ or service valves and check valves as required for complete installation.

SUBMITTALS

Submit product data, drawings and schedule for the following items per the provisions of Division 1.

MATERIALS

Provide two refrigeration oil test kits each containing everything required to conduct one test.

Provide two filter-dryer cartridges of each type.

QUALITY CONTROL TESTING

Test refrigeration system in accordance with ASME.

Pressure test system with dry nitrogen to 200 psi. Perform final tests using electronic leak detector. Test to no leakage.

INSTALLATION GUIDELINES

Install refrigeration specialties in accordance with manufacturer's instructions and as required.

Route piping in orderly manner, parallel to building structure, and maintain gradients as required.

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

Group piping whenever practical at common elevations and locations.

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

Flood piping system with nitrogen when brazing.

Follow ASHRAE procedures for charging and purging of systems and for disposal of refrigerant.

Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

Fully charge completed system with refrigerant after testing.

Provide electrical connection to solenoid valves.

SECTION 15185

HYDRONIC PUMPS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for plumbing and HVAC system hydronic pumps.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Use end-suction pumps for most systems.

Use in-line pumps for 100 gpm or less in hot water heating systems.

Use double-suction pumps for large-capacity hot water and chilled water systems.

Provide pressure gauges for every pump, except small "boosters," which must have gauge cocks only.

Specify that piping and pumps be installed and connections aligned, but not made up, until inspection by UNLV University. All piping must be supported independently of the pumps.

In-line, end-suction and split-case pumps bearing frame and pump internals must be serviceable without disturbing motors or connected piping.

Select pumps for an impeller diameter not greater than 90 percent of the maximum pump impeller diameter.

Select pump motors to be non-overloading at any point along the pump impeller curve.

Select pumps between 65 and 95 percent of best efficiency point along the pump impeller curve.

Specify shaft grounding systems when variable-frequency drives are applied.

SUBMITTALS

Submit the following design, construction, and certification documentation.

Designer Submittals
Submit pump sizing calculations with system sketch.

Construction Documents

Submit the following test reports:
- Installed pump performance test and balance report.
- Pump alignment report

Product Certificates Signed by Manufacturer

Specify that pumps be inspected by the manufacturer's authorized representative who must submit a written report to the engineer with a copy to UNLV University stating that the pump has been properly installed, is operating correctly, and the installation is acceptable to the manufacturer in every respect.

PRODUCT STANDARDS

Products must conform to the following standards:

- Hydraulic Institute standards
- ASME PTC 8.2 and 9
- CSA standards
- UL Motor-Operated Water Pumps Standard

MANUFACTURERS

Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

In-Line Pumps

- Bell & Gossett
- Taco

Booster Pumps-Circulator

- Bell & Gossett (lubricated bearing with oil seals)
- Taco (sealed bearing)

End-Suction Pumps

- Bell & Gossett (Series 1510)
- Armstrong

Double-Suction Pumps

- Bell & Gossett
- Armstrong

Vertical-Split and Split-Case Pumps

- Bell & Gossett (structural steel base with groutable coupling replacement, without removing motor or pump).

Provide pump alignment on a strong base.

Provide an integral, variable-frequency drive for all large pumps over 5hp.

Suction Diffuser

- Bell & Gossett

MATERIALS

Double-Suction Split-Case Pumps

Double suction pumps must have horizontally- or vertically-split casings.

Materials of construction must be a bronze-fitted pump and must include a cast-iron casing, bronze shaft sleeves, alloy steel shafts, and a bronze-enclosed double-suction impeller. Provide re-greasable ball bearings, replaceable casing wear rings (at all critical clearances between the impeller and volute), drains and vents, flexible coupling, coupling guards, and a steel baseplate. At the manufacturer's option, a stainless steel shaft with no sleeve may be substituted for the shaft components.

When mounted vertically, split case must be designed for complete servicing without disturbing piping or alignment.

Pump volute must be supplied with plugged vent drain and gauge tappings at suction and discharge ports.

Provide internally-flushed ceramic seal seats and carbon seal rings.

Where a variable-frequency drive (VFD) is used with the pump, provide an elastomeric coupling that is compatible with the VFD technology applied to the pump.

End-Suction Pumps

End-suction pumps must be base mounted, horizontally coupled, with vertically-split cases.

Materials of construction must be for a bronze, fitted pump and must include cast iron casings; bronze shaft sleeves: alloy steel shafts; and bronze, enclosed impellers. Provide regreaseable or permanently-lubricated ball bearings, replaceable casing wear rings (at all critical clearances between the impeller and volute), drains and vents, coupling guards, and a steel base plate.

Pump casings must have vent and drain ports, and must have gauge ports at the suction and discharge nozzles.

The base plate must be structural steel.

Provide a flexible-type coupler and coupling guard.

Where a variable-frequency drive (VFD) is used with the pump, provide an elastomeric coupling that is compatible with the VFD technology applied to the pump.

In-Line Pumps

In-line pumps must have bronze-fitted construction and must include cast iron casings, bronze or copper shaft sleeves, alloy steel shafts, and bronze impellers. Bearings shall be either sleeve- type or re-greaseable ball bearings.

In-line pumps must have a working pressure of 175 psi, a ceramic seal, and a carbon seal ring.

Pump casings must have vent and drain ports, and must have gauge ports at the suction and discharge nozzles.

Provide replaceable casing wear rings at all critical clearances between the impeller and volute and between the drain and vent connections. Provide a flexible coupling or direct drive connection between the pump and motor. If the schedule pump includes ball bearings and a direct drive motor-to-impeller connection, the submitted pump must not have sleeve bearings or a flexible coupling between the pump and motor.

Pumps for domestic water applications must be of bronze construction.

Where a variable-frequency drive (VFD) is used with the pump, provide an elastomeric coupling that is compatible with the VFD technology applied to the pump.

Pump Motor Drives
All pumps over 5 hp must have a variable-frequency drive.

Accessories or Special Features

Couplings

Couplings must be approved by the UNLV Facilities group.

Strainers

For water service, strainers must be the same size as entering pipe size and have a maximum clean pressure drop of one psi.

Use pump startup strainer screens for cleaning, and remove the afterwards.

Provide a blow-off valve on each strainer. Where feasible and permitted by code, blow-off must be piped to the closest drain.

Suction Diffusers

Suction diffusers must have an angle-type body with inlet vanes and a combination diffuser - strainer orifice cylinder. Suction diffusers must also have 200 psi cast-iron body and stainless steel sleeve with 5/32" perforations. Units must include flanged connections, a removable gasketed cover, a permanent magnet, and straightening vanes.

Provide a 16-mesh startup strainer.

Provide blow-off tapping and a valve on the bottom of the unit.

Provide a full-size inlet and outlet

Triple-Duty Valve

Triple-duty valves must have a combination non-slam check valve with a loaded-weight, contoured disc. The valves must feature calibrated regulation of pump discharge flow and a positive shut-off.

Valves must be repacked under full line pressure.

The valve must be capable of operating in conditions up to 170 psi and 300°F.

Special Requirements

The manufacturer must maintain an inventory of all wearing parts within 50 miles of Las Vegas, NV.

INSTALLATION GUIDELINES

Provide pump suction fittings on the suction sides of base-mounted, centrifugal pumps.

Provide combination pump discharge valves on the discharge sides of base-mounted centrifugal pumps.

Support pump fittings with floor-mounted pipe and flange supports.

Each pump must be level and re-aligned. Base-mounted pumps must be grouted.

Provide a spring-loaded check valve in the pump discharge, in lieu of a swing check valve.

All steam and condensate pumps must be vented to the outdoors.

All steam and condensate pumps must be fitted with wafer check valves, thermometers, and Y-type strainers.

The receivers on condensate pumps must be sized for a minimum of 15 minutes of net storage.

All duplex pump sets require electric alternators for the two pumps.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards and listed in the project specifications do not conflict with commissioning procedures for testing and training.

Specify that at least one final alignment be performed in the field.

SECTION 15186

STEAM AND CONDENSATE PUMPS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for steam and condensate pumps. This section is under further development, in that no new systems are anticipated.

SECTION 15189

HVAC WATER TREATMENT

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains HVAC system water treatment design criteria.

Related Section: Section 15545- Chemical Water Treatment.

SUBMITTALS

Submit a water treatment analysis.

INSTALLATION GUIDELINES

Install coupon racks for heating, cooling and condenser water systems in an accessible location on all closed hydronic systems, and insulate pipe and equipment for chilled water systems and/or all which may condensate.

Install chemical shot feeders in areas that are easily accessible and where shot feeders can be washed down.

Provide a means for lifting and moving chemical treatment drums.

Clean and flush all water lines before connecting them to the central plant.

Provide backflow preventers on all systems using chemical treatments.

Provide a means of secondary containment for all chemical treatment drums.

Provide design criteria that requires treatment to UNLV standard.

SECTION 15190

MECHANICAL IDENTIFICATION

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for mechanical systems identification. See Section 13915 for fire suppression system identification.

System Design and Performance Requirements
Ensure that identification systems are compatible with existing systems and arc consistent throughout the project. Provide for future additions to the systems.

References
Identification of mechanical systems shall be done in accordance with ANSI/ASME A13.1.

Piping
All interior piping and water flow systems shall be marked and identified throughout the building as to their function and direction of flow. Identification shall be installed in clear view and aligned with axis of pipe. Identification shall be located not to exceed 20 feet apart on straight runs, including risers and drops, adjacent to each valve and "T", at each side of penetration of structure or enclosure, and at each obstruction.

Unique Identification
Each individual piece of equipment shall have its own unique identification number. Identifying identical pieces of equipment at multiple locations with the same number is not acceptable.

Equipment Identification
Each air handling unit, exhaust fan, and all equipment on drawing schedules shall be identified with an engraved plastic nameplate permanently attached. The plastic plate shall be black with 1/2" high white letters.

Power Source Identification
Each piece of equipment shall have a permanent label describing the location of the power source. The label shall contain the room number the electric panel is located in, the electric panel name and the circuit number. As an example, the label for an exhaust fan fed from circuit 23 of electrical panel '1L1' located in Room 120 would read "Rm 120, '1L1'-23".

Exhaust Fans
All exhaust fans shall have a label permanently attached name plate describing the area or room the fan serves. Provide each with its individual disconnect switch. Direct drives are preferred, and with VFD's on motors larger than two-horsepower. Insulated fan curb height shall be 12".

Controls
Control panels and major control components shall have engraved plastic nameplates permanently attached. The plastic plate shall be black with 1/2" high white letters.

Valves
All valves shall be identified with tags. Provide full-port ball valves for use through to 2”, and butterfly valves for uses greater than 2”. Wafer type valves shall be lug type. Valves shall be UL or FM listed for their intended use and application.

Ductwork
All exhaust ductwork shall have stenciled painting identifying the exhaust fan and room served. The identification shall be located at each side of structure penetration or enclosure and at each obstruction. Construction shall be in accordance with the latest SMACNA Duct Construction Standard, and leakage as determined by the air-balance contractor/ consultants reported test results shall be limited to five percent or less. Construction standards shall be based upon the design/specified use and corresponding fan total static pressure plus a factor of safety of fifty percent, unless specified otherwise. One inch thick, two pound per cubic foot density thermal and acoustical liner shall be provided in the last ten feet of duct at the fans intake, or three feet beyond the first elbow, whichever is greater.

Valve and Terminal Unit Chart and Schedule
Valve and terminal unit charts and schedules shall be provided in an aluminum frame with a removable clear plastic shield. The chart and schedule shall contain the equipment identification number, location, function, area served and manufacturer’s name and model number. The chart and schedule shall be installed in a location approved by the UNLV Office of Planning and Construction, included in the O&M manuals, and other specified locations.

Plumbing Systems Identification
Provide color-coded pipe identification markers on piping installed per this section. Use snap- on, laminated, plastic pipe markers protected with a clear acrylic coating. Apply pipe markers after architectural painting where such painting is required.

Provide an arrow marker with each pipe content marker to indicate the direction of flow. If flow can be in either direction, use a double-headed arrow marker.

Pipe markers must have legends and color coding with black letters. Apply markers to all piping per Table I, regardless of under-jacket colors.

Table 1. Pipe Marker Color Coding

Service	Legend	Background Color
Cold water	Cold water	Green
Hot water	Domestic hot water	Yellow
Hot water return	Domestic hot water return	Yellow
Protected cold water	Protected cold water	Yellow
Protected hot water	Protected hot water	Yellow
Protected hot water return	Protected hot water return	Yellow
Non-potable water	Non-potable	Yellow
Compressed air	Compressed air	Green
Sanitary	Sanitary Sewer	Green
Vent	Vent	Yellow
Rainwater	Storm Sewer	Green

Pump discharge	Pump discharge	Green
Pure water	Pure water	Green
Vacuum	Vacuum	Green
Central vacuum	Vacuum	Yellow
Lab waste	Lab waste	Yellow
Lab vent	Lab vent	Yellow
Reclaiming/Gray water	Gray water	Purple
Tempered water	Tempered water	Green
Tempered water return	Tempered water	Green

Use colored PVC jackets in penthouses, plumbing rooms, shipping docks, janitor's closets, and other areas without hung ceilings. Cover all insulated plumbing piping exposed in mechanical rooms with a Ceel-Co plastic jacket. The system identification and color pattern legend must be per Table 2.

Table 2. System Identification and Color Patterns

Piping System (and Legend)	Color
Potable Cold Water	Green, Blue,
Potable Hot Water	Green. Blue.
Non-Potable Cold Water	Yellow. Gray.
Non-Potable Hot Water	Yellow. Gray.
Storm Drain	Purple.
RODI Water	Yellow. White.
Gray Water	Purple. Blue
Tempered Water	Green. Blue

Plastic jackets include fitting and piping covers.

Insulate and finish the piping to be covered with plastic jackets, per this section, then apply the plastic jackets.

Tags, Valves, Equipment, and Instruments

Upon completion of work, attach engraved laminated plastic tags to all valves and instrumentation. In every mechanical space, tags must be seen when hung with valve/riser charts.

Equipment must bear stamped, stainless steel tags.

Tags must be numbered consecutively with black characters on a white face. Tags for general valves must be prefixed with the letter P. Tags must bear the number used in the P&DDs for those items so marked. Numerals must be at least 3/8" high.

Embossed or engraved aluminum or brass tags may be substituted for stainless steel or laminated tags, if desired.

Tags must be at least 1" in diameter, at least 1/8" thick, and attached by S-hooks and chains.

HVAC Systems Identification

Stencil ductwork at each junction or branch takeoff, at least once in each room, and at intervals not longer than 20 feet. Stencils must clearly identify the duct service area (S for supply, R for return, X for exhaust) served by the branch, and must include an arrow indicating the direction of flow.

Provide color-coded pipe identification markers on piping installed per this section. Use snap- on, laminated, plastic pipe markers protected with a clear acrylic coating. Apply pipe markers after architectural painting where such painting is required.

Provide an arrow marker with each pipe content marker to indicate the direction of flow. If flow can be in either direction, use a double-headed arrow marker.

Label mains:

- At points of entrance and exit from mechanical rooms
- Adjacent to each valve
- On each riser
- At each tee fitting
- At points of entrance and exit from building
- At least once in each room
- At intervals no longer than 20 ft
- The size of legend letters on markers and the length of the color field must be per the latest edition of ANSI.

Use the color-coding in Table 3, with names in black letters on a white background and white letters on a green background.

Table 3. Pipe Marker Color Coding

Service	Legend	Background Color
Chilled water supply	CHWS	Green
Chilled water return	CHWR	Green
Hot water supply	HWS	Yellow
Hot water return	HWR	Yellow
Cold water	Cold water supply	Green
Low pressure condensate return	LPR	Yellow
Medium pressure condensate return	MPR	Yellow
High pressure condensate return	HPR	Yellow
High pressure steam	HPS	Yellow
Low pressure steam	LPS	Yellow

Medium pressure steam	MPS	Yellow
Pumped condensate	PC	Yellow
Steam	Steam	Yellow
Glycol supply	GS	Yellow
Glycol return	GR	Yellow

PRODUCT STANDARDS

Color banding must meet the latest ANSI and OSHA requirements.

Manufacturers
- Ceel-Co plastic jacket.
- Seton Name Plate Corporation
- Marking Services Incorporated
- Approved equal

Materials
- Use Setmark markers by the Seton Name Plate Corporation, or approved equal.

INSTALLATION GUIDELINES

Mains shall be labeled at points of entrance and exit from mechanical room, adjacent to each valve, on each riser, at each tee fitting, at points of entrance and exit from building, at least once in each room, and at intervals no longer than 20'.

In general, use 2" high legends for 4" and larger diameter pipe lines, and 3/4" high legends for pipe lines 3" diameter and smaller pipe lines.

Use screws or rivets to securely attach nameplates, catalog numbers, and rating identifications to mechanical and electrical equipment. The use of adhesives or cements is not permitted.

Identify non-potable water outlets with permanently attached, yellow color-coding or 4" high triangle tags that read "Water unsafe."

Coordinate the numbering system with existing piping tags to avoid duplicate numbers.

SECTION 15194

FUEL GAS PIPING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for fuel gas systems. All work of this section shall meet the Nevada State and UFC standards.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Gas detection devices are required for labs with gas outlets. The piping at the building entrance shall have a California Seismic Gas Shutoff valve to automatically shutoff gas to the building in the event of an earthquake.

Underground installations: Schedule 40 welded carbon steel pipe “Ex-Tru-Coat” or fusion welded polyethylene. For carbon steel pipe weld joints and wrap all joints with 2 layers of 3 mil. plastic tape. Provide sacrificial anodes with testing well every 200 feet. Test piping at 70 lbs. for 24 hours.

Above-grade natural gas line: Schedule 40, A53 carbon steel pipe with malleable iron threaded fittings 2-/12 inch diameter and larger and schedule 80 for less than 2-/12 inch for gas pipe inside buildings. To be tested with compressed air at 35 lbs. for 24 hours.

All gas lines shall be tested to fixture with monometer by a licensed contractor with a gas card.

SUBMITTALS

Submit the following design and construction documentation.

Designer Submittals

Submit fuel gas calculations, with pipe sizes and sketch, for each gas-user system.

Construction Documents
- Submit pipe cleaning and pipe pressure test reports.

MATERIALS

Natural gas.

Maximum operating limits: 50 psig, 70°F maximum temperature, carbon steel.

SECTION 15211

GENERAL SERVICE COMPRESSED AIR PIPING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for non-medical compressed air piping systems and accessories.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Design compressed air systems for longevity, durability, and flexibility.

SUBMITTALS

Submit compressed air calculations, with sketch, for compressed air system equipment selection and piping.

MATERIALS

Compressed air—maximum operating limits: 125 psi, 120°F, copper or 314 stainless steel.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

SECTION 15212

VACUUM PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for pipe, fittings, and specialties for laboratory air and vacuum systems.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Design laboratory air and vacuum systems for longevity, durability, and flexibility.

Design compressed air and vacuum systems for medical, surgical, dental, and laboratory facilities to be completely independent of each other.

Provide a dew point monitor for the compressed air system, and the list the required system dewpoint in the contract documents.

SUBMITTALS

Submit the following design and construction documentation.

Designer Submittals
Submit laboratory air and vacuum calculations, with sketch, for piping and equipment selection.

Construction Documents
Submit pipe cleaning and pipe pressure test reports.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

SECTION 15213

GAS PIPING FOR LABORATORY AND HEALTHCARE FACILITIES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for pipe, fittings, and specialties for medical gas piping systems.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Design laboratory air and vacuum systems for longevity, durability, and flexibility.

Design compressed air and vacuum systems for medical, surgical, dental, and laboratory facilities to be completely independent of each other.

Provide a dew point monitor for the compressed air system, and list the required system dewpoint in the contract documents.

SUBMITTALS

Submit the following design and construction documentation.
- Designer Submittals
- Submit medical air and vacuum calculations, with sketch, for piping and equipment selection.
- Provide dewpoint.

Construction Documents
- Submit pipe cleaning and pipe pressure test reports.

MATERIALS

Medical Air—maximum operating limits: 125 psi, 120°F copper or seamless 314 stainless steel.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

SECTION 15250

MECHANICAL INSULATION

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

System Design and Performance Requirements

Piping
All hydronic piping and domestic hot water piping shall be insulated. Preformed plastic covered sections shall be used for interior straight runs with preformed elbow and fitting plastic covered sections used for joints and fittings. Insulation shall be a minimum of one inch thick.

Asbestos containing materials shall not be used.

The insulation shall have a reinforced vapor barrier outer jacket, impervious to the effects of ultra-violet radiation, or provided with stainless steel jacket for pipe and fittings for exterior applications.

Points of support shall be rigid prefabricated or manufactured lengths of calcium silicate or other approved products for this application.

All joints and connections shall be sealed to prevent condensation on all chilled water, refrigerant, or other piping containing media whose temperature is less than the design dew point temperature.

All insulation materials and adhesives shall meet the smoke and flame spread criteria for use in a return air plenum.

SECTION 15251

GENERAL SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for non-medical, general service compressed air equipment, including air dryers.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Design compressed air systems for longevity, durability and flexibility. All compressors shall be oil free and of the maximum efficiency.

Manufacturers
Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

- Ingersoll Rand
- Scales
- Zerk (air dryers)

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

SECTION 15252

LABORATORY AIR AND VACUUM EQUIPMENT

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for laboratory air and vacuum systems equipment, including air dryers.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Design laboratory air and vacuum systems for longevity, durability, and flexibility. All equipment shall be oil free and water free, and of the maximum operating efficiency.

Vacuum pumps serving laboratories must be duplex package, with receivers, alarms, and control panels. Each pump must be capable of carrying the entire load.

Air compressors serving laboratories must be duplex or triplex package, with alarms, desiccant dryers, receivers, and control panels.

Design compressed air and vacuum systems for medical, surgical, dental, and laboratory facilities to be completely independent of each other.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

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Technical Design Guidelines

SECTION 15255

MEDICAL AIR AND VACUUM EQUIPMENT

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for medical air and vacuum systems, including compressors, dryers, purification, filters and vacuum pumps, and oral evacuation systems.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Design laboratory air and vacuum systems for longevity, durability, and flexibility.

Vacuum pumps serving medical facilities must be duplex package, with receivers, alarms, and control panels meeting NFPA 99 requirements. Each pump must be capable of carrying the entire load.

Air compressors serving laboratories must be duplex or triplex package, with dryers, receivers, alarms, and control panels. Air compressors must meet NFPA 99 requirements.

Design compressed air and vacuum systems for medical, surgical, dental, and laboratory facilities to be completely independent of each other.

Provide a dew point monitor for the compressed air system, and list the required system dewpoint in the contract documents.

MANUFACTURERS

Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

- ITT Domestic Clinical
- Nash
- Beacon Medical
- Ingersoll-Rand

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

SECTION 15300

FIRE PROTECTION

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for the Fire Protection.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Fire Hydrants
All fire hydrant installations shall conform to Clark County Fire Department specifications, and the Nevada State Fire Marshall. Plans must be submitted and approved prior to the ordering of equipment or the beginning of work. UNLV Planning and Construction shall review the submittals for scope of work completeness prior to submittal to the authorities having jurisdiction for approval.

Fire Protection Service
The fire sprinkler water service to each building shall incorporate a double check detector assembly or a reduced pressure backflow preventer to protect the water supply from backflow. The selected device shall be located as directed by TMWA and Facilities Services.

Fire Protection Piping
All fire protection systems shall be designed in accordance with NFPA 13. All building fire suppression piping systems shall be made with A53 Grade B carbon steel pipe. Threaded pipe fittings with schedule 40 steel pipe or Victualic fittings with ASTM A135 schedule 10 steel pipe.

All devices shall be UL listed.

Provide a separate fire riser with is accessible from outside the building.

Provide a separate fire sprinkler floor plan sheet to clarify/indicate the general fire sprinkler system requirements. That sheet should indicate as a minimum the fire riser location, a fire riser diagram, and the location of the inspector’s test station (at a location that is substantially remote from the fire riser location.)

SECTION 15400

PLUMBING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for General Plumbing Design.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

1. Roof Drain
   Do not attach roof drains to structural members. Roof drains shall be piped to storm sewer if available. Do not pipe roof drains to any sidewalk or pedestrian paths. Provide splash blocks in landscape areas. No scuppers or external gutter and downspout systems allowed. Roof drains and covers shall be cast iron. Plastic drains are prohibited.

2. References
   Plumbing installation shall conform to the requirements of Nevada Revised Statute 338.193 for Standards for plumbing fixtures.

3. Backflow Prevention
   All connections to water supply systems shall have backflow preventers. This includes connections for domestic water, irrigation, and fire sprinkler systems. Depending on location of the project, the water supply system may be owned by either the Las Vegas Valley Water district or UNLV.

4. Backflow Preventers
   Backflow preventers shall be listed on the most recent "List of Approved Backflow Prevention Assemblies" published by the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California. A manufacturer's label verifying approval by the Foundation for Cross-Connection Control and Hydraulic Research of the University of Southern California shall be provided with each backflow preventer.

5. Backflow Preventer Locations
   Backflow preventers shall be mounted above ground in a weather sheltered area with at least three feet of clear space on either side of the preventer. The backflow preventer shall be located so no part of the building needs to be dismantled to replace the preventer. All exterior locations or other sites subject to freezing shall be provided with insulated, lockable hot boxes.

6. Water hammer arrestors shall be provided as required to protect against noise and damage from water hammer (sizes and locations shall be in accordance with UPC, chapter 6).

7. Valve Type
Ball valves shall be used whenever possible.

8. Isolation Valves
At a minimum, isolation valves shall be installed on the hot and cold water supply for each floor of the building. Isolation valves shall be installed on main water lines to each building of a multi-building complex.

9. Isolation Valve Location
The isolation valves shall be located for easy access in an emergency. Isolation valves shall be wall mounted no lower than 3 feet and no higher than 5 feet. The location shall be equally accessible to both sexes.

10. Floor Drains
Every toilet room and custodial room shall have a floor drain. The floor drain shall be located at the lowest point in the floor. If the floor drain is not at the lowest point in the floor, the situation shall be corrected at no cost to UNLV. Provide trap primers on all floor drains, or floor sinks.

    a. Accessible shut-off valves shall be installed to allow for isolation of groups of plumbing fixtures, restrooms, and each floor of multi-floor buildings for all piping systems.

    b. A shut-off valve and pressure reducing valve and pressure reducing valve with full size bypass shall be installed on the domestic cold water riser in each building.

    c. All boiler and cooling tower feeds must be equipped with approved back flow preventer.

11. Oversize Floor Drains
All air handler and mechanical equipment rooms shall have oversize drain located at the lowest point of the floor. If the floor drain is not at the lowest point in the floor, the situation shall be corrected at no cost to UNLV.

12. Perchloric Acid Fume Hoods
Perchloric acid fume hood washes shall drain to the sanitary sewer. For other fume hood requirements refer to the UNLV Department of Environmental Health and Safety “Chemical Fume Hood Guide”.

13. Roof Drains
Roof drains shall be connected to storm sewer wherever possible. Roof drains shall not discharge onto any paved pedestrian areas or walkways. Minimum size for all roof and over-flow drains shall be 3”. All outflows through the building walls above grade shall be via a J.R. Smith Figure 1770 downspout, or equal.

14. Drain Tests
The drains shall be checked to be clear by running a television camera through the piping. Any abnormalities, including, but not limited to construction debris, pulled out joints, broken pipe, and improper slope shall be corrected at no cost to UNLV. The television run shall be witnessed by representatives of the UNLV Office of Planning and Construction. Results acceptable to UNLV Office of Planning and Construction must be obtained prior to issuance of substantial completion.

15. Plastic Piping
Plastic piping shall not be used inside any building, except for acid waste piping, deionized water piping, or other process piping when and if specifically approved by UNLV. In cases where plastic piping is approved to be utilized inside a building the piping shall have a flame spread and smoke developed rating of 25/50 or less.

16. Underground Piping
In cases where plastic piping is utilized below a floor slab (to accommodate corrosive soil conditions or to accommodate other unusual design parameters) the requirements for bedding depth, bedding width, and bedding material shall be carefully evaluated, clearly specified, and the piping system installation shall be inspected and approved prior to covering. The transition from plastic to cast iron shall be made approximately three inches above the floor slab with flexible coupling.

17. Faucets

a. Faucets shall be Moen, Chicago, or Zurn infrared type automatic faucet battery powered. Faucets with plastic internal parts are <u>unacceptable</u>. Symmons or Sloan faucets are unacceptable.

b. Wherever a plumbing pipe penetrates a concrete slab-on-grade the pipe shall be protected with a minimum of ½” thick insulation (typically closed cell elastomeric type insulation). Where site water table conditions warrant, pipe sleeves & water-tight seals shall be specified at each penetration of a floor slab or foundation wall.

18. Toilet Room Hose Bibs
A lockable cover, loose keyed hose bib shall be provided in each toilet room. The hose bib shall be attached to the hot water supply. This hose bib is used for power wash down of the room.

19. ADA Protection
Sinks intended for ADA compliance shall be designed from the start for compliance. A stainless steel panel restricting access to supply and drain pipes or commercially available preformed pipe jackets are acceptable methods. Supply and drain pipes wrapped with foam pipe insulation as an afterthought is unacceptable.

20. Flushometers

Automatic flushometers shall be battery powered, infrared type with a manual override button.

SECTION 15410

PLUMBNG FIXTURES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for plumbing fixtures, including faucets and flush valves.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Design the plumbing system for safety, longevity, durability, and flexibility. Provide thermostatic mixing and pressure balancing valves for all baths and showers.

1. Water Conservation
   All plumbing fixtures shall be specifically designed to conserve water. Maximum water usage by specific fixture type shall be as follows:

Water Closets	1.6 gallons per flush
Urinals	0.5 gallons per flush
Restroom lavatories	2.2 gallons per minute (automatic shut off at .25 gallons or less)

2. Fixture Quantities (General)

   a. UNLV will not tolerate under-fixturing on individual floors or in specific building areas. All designs must meet the potty parity as required by local and state codes.

   b. Base quantities on the anticipated maximum, normal-use building capacity.

   c. Quantities must be satisfactory to code-enforcing officials and/or funding agencies. Use the quantities listed in Table 1 as a guide for preliminary planning.

   d. For all new or remodeled building construction, the aim is to satisfy anticipated demand. However, avoid over-fixturing because of the comparatively high cost of these facilities and spaces.

   e. When comparing proposed quantities to codes or other required standards, be aware that codes and standards usually apply to fixture totals for an entire single-type occupancy building. Therefore, fixture quantities on each floor of such a building need not necessarily meet codes or standards.

3. Fixture Quantities
Verify fixture quantities as specified by state and local building codes.

a. Office Buildings
The OSHA quantities for water closets and urinals listed in Table 1 are satisfactory.

Table 1. Fixture Quantities (modify to meet PP)

Water Closets, Lavatories, and Urinals					
	Men		**Women**		**Men& Women**
Persons	**WCs**	**Urinals**	**WCs**	**Persons**	**Lavatories**
1-5	1	0	1	1-15	1
6-15	1	0	1	16-36	2
16-35	2	0	2	31-60	3
36-55	2	1	3	61-90	4
56-80	3	1	4	91-125	5
81-110	4	1	5	126-170	6
111-150	4	2	6	171-205	7
151-190	5	2	7		

b. Research Buildings
Per code, fixture quantities should be the same as for office buildings, but only if it is anticipated that all occupants will be in the building as constantly as occupants of an office building. If the building program does not define this constancy, it must be determined for its effect on fixture quantities. If proposed quantities are less than the code requirements, a code exception will be investigated.

c. Places Of Assembly
Designers may recommend fixture quantities in places of assembly. See the applicable code for minimum requirements. However, provide no less than two of each type of fixture in any one toilet room.

d. Libraries
Per code, a library, depending on its type, could fall into either the same category as an office building or in the public or semi-public building category. Evaluate each library according to its type and category. Some small libraries can be categorized as classrooms. A large library, such as Sterling Memorial, could fall into a category not covered by code. As a guide for such a separate category, about one sanitary fixture (water

closet or urinal) per 50 reader seats (and about the same number of lavatories) should be adequate, if facilities for staff are considered separately. A proposal involving such a separate category should be approved by code or funding authorities prior to incorporation into a building.

e. Classroom Buildings
UNLV does not yet have an inventory of fixtures (and adequacy of same) in its classroom buildings. Until such an inventory is available, use Table 2 as a guide. The number of fixtures must be approved by code or funding authorities before incorporation into a building. However, unless the anticipated use by either sex is nominal (under 25), provide at least two of each fixture for each sex.

Table 2. Classroom Fixtures

	Fixture Type	**Student Stations per Fixture**
Men	WCs Urinals Lavatories	100 110 150
Women	WCs Lavatories	60 100

f. Other Building Types
If fixture quantities are not stated in the building program for other types of buildings, base the quantities on modifications of those developed by the architect and approved by UNLV University and code or funding authorities for the types of buildings listed above.

g. Counting Fixtures for the Handicapped
Include all fixtures provided for the physically handicapped in the fixture count. Wherever "unisex" toilet rooms are used, apply each WC as a deduction from the combined requirement for both sexes before apportioning the remaining needs among such gang toilet rooms as might be designated for each sex. Unisex toilet rooms are preferred, where feasible, for this use.

4. Mounting of Fixtures
Hang fixtures on walls wherever possible. Use chair hangers or (as for a battery of lavatories) a less expensive substitute.

5. Fixture Types

a. Lavatories
UNLV prefers vitreous china lavatories with integral back and front faucets. The minimum size is 20" W x 18" outside. Space is 26" o.c.

b. Water Closets
Water closets must be elongated, siphon-jet action, with open front white seats. Include flush valves where feasible.

c. Urinals
Urinals (men only) must be vitreous china, siphon-jet action, with flush valves. For standards of quality, see the manufacturers and model numbers listed below under Manufacturers.

6. Plumbing Fittings
For lavatory faucets, use fittings that are not self-closing.

7. All new construction shall include automatic flush devices and faucets.

MANUFACTURERS

Subject lo compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

1. Faucets

a. Moen

I. MOP Sink 8124.

II. LAV 8551 with plate and 4 inch spread

III. Kitchen commercial/professional

b. Zurn

I. LAV 26915

II. LAV 26913

c. T&S

I. Kitchen / commercial

II. MOP Sink B-0230-LN

d. Kohler / commercial

e. American Standard

2. Metering Faucets

   a. Kohler S-60-G (for a regular sink temperature selection and 4" centerset grid strainer drain assembly)

   b. T&S Laboratory

3. Shower Valves

   a. Symmons 4-500-X

   b. Symmons 1-500, for PWG

   c. Moen T46991 with integral stops

4. Angle Stops

   a. Brasscraft SCR19 Series

   b. Dahl 611-33-31 Series

5. Janitor's Sink

   a. Kohler K-6718, (wall hung K-6673 trap standard adjust for 3" IPS connect c.o. plug strainer s.s. rim guard, black back)

   b. American Standard 7692.023

6. Mop Basin

   a. Fiat MSB-3624, 36" x 24" x 10" with shelf

   b. MSB-2424, 24" x 24" x 10" without shelf

7. Dorm Sinks

   a. Kohler K-6718

   b. American Standard 7692.023

8. Dorm Sinks-Cast Iron , Enamel

   a. Kohler K-2861

   b. American Standard 4869.012 (dorm sink, wall mount 19" x 17" with 4" faucet center)

9. Dorm Sinks

   a. Kohler

      I. K-6562 (counter top bar)

      II. K-2904 (counter top 4")

      III. K-2900 (counter top)

      IV. K-5964 (kitchen single)

      V. K-5965 (kitchen single)

      VI. K-5961

      VII. K-3283

   b. American Standard

      I. 7185.803 (sink 3 hole drill)

      II. 3303.00 (faucet center)

      III. 3211.000 (4" faucet center metal frame)

      IV. 7024.804 (basin, 4 hole or drillings, 7172.804)

      V. 7024.803 (basin, 3 hole or drillings, 7172.803)

      VI. 7172.803 or 7024.803 (kitchen single, basin 3 hole drillings)

      VII. ELKAY PSR-3322-4 (kitchen double basin, 4 hole drillings)

10. Dorm Sinks, Vitreous China, Handicapped

   a. Kohler

      I. K-12636 (handicapped sink)

      II. K-2032 (handicapped sink)

      III. K-2054 (handicapped sink)

   b. American Standard

      I. 9141.011 (wall mount 27" x 20" with 4" faucet center)

      II. 0355.012 (wall mount, back splash, 4" faucet center concealed arm carrier)

III. Wall mount to back splash 4" faucet center concealed arm carrier

11. Urinal, Vitreous China, Regular Use and Handicapped

a. Kohler K-4985 (regular use)

b. American Standard 6561-017 (wall-mount, siphon-jet action, 3/4" top spud inlet, 2" IPS outlet)

c. Kohler K-5014-T (handicapped)

d. American Standard 6541.132 (regular use, wall mount, siphon-jet action, 1/4" top spud inlet, 2" IPS outlet)

12. Toilets, Wall Mount

b. Kohler K-4430-ET (wall mount)

c. American Standard 2257.103 (3.5 gallon)

13. Water Closet, Vitreous China; Regular Use and Handicapped

a. Kohler K-4430-ET (regular use)

b. American Standard 2257.103 (handicapped use, water saving siphon-jet action, 2-1/2" passageway, 1-1/2" top spud)

c. Kohler K-4250 (regular use, floor mount, water-saving siphon-jet action, 2-1/2" passageway, 1-1/2" top spud, 10" - 12" roughing in)

d. Kohler K-3420-ET (regular use)

e. American Standard 2234.015 (floor mount, tank type, 1-3/4" passageway, 3/8" IPS water supply, 12" roughing in)

f. Kohler K-3527-EB (handicapped)

g. American Standard 2216.143 (3.5 gallon use, floor mount tank type, 18" high bowl, 3/8" IPS water supply, 10" roughing in)

h. Kohler K-4268 (handicapped)

i. American Standard 3043.102 (regular use, floor mount siphon-jet action, 18" high bowl, water saving, 2-3/4" passageway, 1-1/2" top spud, 12" roughing in)

14. Toilet Tank

    a. KohlerK-2867

15. Tubs

    a. Kohler K-4250 (floor mount)

    b. Kohler K-4330 (wall hung)

    c. Kohler K-4350ET (floor bolted)

    d. Kohler, K-3420EB (floor bolted)

    e. American Standard 2234.015 (3.5 gallon)

16. Flush Valves

    a. Moen
        1. Urinal #8312
        2. Water closet flush valve model # 8310DF16

    b. Sloan -186 Royal (for regular urinal, 3/4" IPS angle stop, coupling for 3/4" top spud, 1 to 1-1/2" high)

    c. Sloan Royal 180 (for handicapped urinal, 1" IPS angle stop, coupling for 1-1/4" top spud, 11 -1/2" high)

    d. Sloan Royal (for regular and handicapped water closet, 1" IPS angle stop, coupling for 1-1/2" top spud, 11-1/2" high)

17. Lab Faucets

    a. Chicago 876-F3CP-VP

    b. Speakman SC-3004

    c. Moen S0003 (spout only, 8132 handles only)

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

SECTION 15412

EMERGENCY PLUMBING FIXTURES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for emergency eyewash and shower units.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Design the plumbing system for safety, longevity, durability, and flexibility.

Provide a tempered water supply for all emergency showers and eyewashes.

Eyewashes must be full-face.

Product Standards

Products shall conform to ANS1-358.1 standards.

MANUFACTURERS

Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

- Emergency Showers
- Speakman
- Symmons
- Emergency Eyewash Units: Haws

INSTALLATION GUIDELINES

Install the floor drain beneath the emergency shower.

Verify that tempered water has been specified for emergency fixtures.

In conjunction with code and standard requirements, emergency showers must be located in adjacent corridors or at the hazard room door exits. The showers are to be accessible, require not more than 10 seconds to reach, and be within a travel distance of no greater than 50 ft from the hazard rooms.

Provide emergency showers and eyewash fountains for:

- Laboratories
- Boiler rooms
- Cooling towers
- Chemical treatment areas
- Deionizing acid regenerant tank
- Battery charging rooms

Provide additional emergency showers and eyewash fountains in other areas that:

have hazardous materials that will be used in the area

have no other emergency showers and eyewash fountains located within 50 feet of the area.

Provide full-size ball valves to isolate emergency showers or eyewash fountains. Lock the valves in the open position.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

SECTION 15415

DRINKING FOUNTAINS AND WATER COOLERS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for drinking fountains and water coolers.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Design the plumbing system for safety, longevity, durability, and flexibility.

Fixture Quantities (General)
UNLV will not tolerate under-fixturing on individual floors or in specific building areas.

Base quantities on the anticipated maximum, normal-use building capacity.

Quantities must be satisfactory to code-enforcing officials and/or funding agencies.

For all new or remodeled building construction, the aim is to satisfy anticipated demand. However, avoid over-fixturing because of the comparatively high cost of these facilities and spaces.

When comparing proposed quantities to codes or other required standards, be aware that codes and standards usually apply to fixture totals for an entire single-type occupancy building. Therefore, fixture quantities on each floor of such a building need not necessarily meet codes or standards.

Fixture Quantities
Verify fixture quantities as specified by state and local building codes.

Product Standards
Products must conform to ANSI/NSF 61 standards.

MANUFACTURERS

Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

- Halsey Taylor
- Elkay
- Oasis

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

SECTION 15441

DOMESTIC WATER PUMPS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section includes design criteria for inline, end suction, and water pressure boosters for domestic water pumping systems.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Provide a three-pump system for water booster pumping. Size one pump for approximately 1/3rd of the total water demand. Size each of the other two pumps for approximately two-thirds of the total water demand. Design the system so the smaller pump will run constantly until the water demand exceeds the capacity of the pump, at which point the smaller pump will stop and one of the large pumps will start. When the water demand exceeds the capacity of the larger pump, the smaller pump will automatically restart and operate together with the larger pump to provide the total water demand. The third pump will act as a standby pump. The pumps must be free of cavitation over their operating range.

The system must be controlled by a combination of flow or pressure switches and pressure-regulating valves, and must be designed to prevent water hammer.

Provide pressure gauges for every pump.

Specify that piping and pumps be installed and connections aligned, but not made-up, until inspection by UNLV. All piping must be supported independently of the pumps.

In-line, end-suction, and split-case pumps bearing frame and pump internals must be serviceable without disturbing motors or connected piping.

Select pumps for an impeller diameter not greater than 90 percent of the maximum pump impeller diameter.

Select pump motors to be non-overloading at any point along the pump impeller curve or in combination with other pumps.

Provide pressure gauges for every pump, except small so-called "boosters" which must have gauge cocks only.

Select pumps between 65% and 115% of best efficiency point along the impeller curve.

Provide an accumulator type storage tank to reduce the number of pump starts

Provide and digital annunciator compatible with the campus EMS system to communicate the booster system status continuously.

SUBMITTALS

Submit the following construction and certification documentation.

Construction Documents
Submit the following test reports:
- Installed pump performance test and balance report.
- Pump alignment report

Product Certificates Signed by Manufacturer
Specify that pumps be inspected by the manufacturer's authorized representative who must submit a written report to the engineer with a copy to UNLV stating that the pump has been properly installed, is operating correctly, and the installation is acceptable to the manufacturer in every respect.

PRODUCT STANDARDS

Products must conform to the following standards:
- Hydraulic Institute standards
- ASMEPTC8.2and9
- CSA standards
- UL Motor-Operated Water Pumps Standard

MANUFACTURERS

Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

In-Line Pumps
- Bell & Gossett
- Taco

Booster Pumps: Circulator
- Bell & Gossett (lubricated bearing with oil seals)
- Taco (sealed bearing)

City and Hot Water Pressure Booster Pumping Systems
- Bell & Gossett (multiple control panel, 2-3 pumps with small tank)
- Tiger Flow (single control panel, 2-3 pumps with small tank)
- Canaris Corporation
- Synchroflo Corporation
- Suction Diffuser
- Bell & Gossett
- Taco

MATERIALS

All wetted parts in recirculation hot water pumps and in-line boosters must be of bronze construction.

Accessories or Special Features

Couplings
Couplings must be approved by the UNLV Facilities group.

Strainers
For water service, strainers must be the same size as entering pipe size and have a maximum clean pressure drop of one psig.

Use pump startup strainer screens for cleaning, and remove them afterwards.

Provide a blow-off valve on each strainer. Where feasible and permitted by code, blow-off must be piped to the closest drain.

Strainer material for use in domestic water systems must be of stainless steel construction.

QUALITY CONTROL TESTING

After factory assembly, the packaged pumping system must be hydrostatically tested and undergo a complete electric and hydraulic test from 0 to 100% design flow at the factory.

All controls, pump sequencing devices, alarms and instrumentation must be tested and calibrated for proper operation during factory testing.

INSTALLATION GUIDELINES

Specify that pumps be aligned, doweled, and grouted.

Provide pump suction fittings on the suction sides of base-mounted, centrifugal pumps.

Provide combination pump discharge valves on the discharge sides of base-mounted centrifugal pumps.

Support pump Fittings with floor-mounted pipe and flange supports.

Each pump must be level and re-aligned. Base-mounted pumps must be grouted.

Provide a spring-loaded check valve in the pump discharge, in lieu of a swing check valve.

If the pump motor is above 15 hp, provide a beam or rail system for removal from a crowded mechanical room.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

Specify that at least one final alignment be performed in the field.

SECTION 15480

DOMESTIC WATER HEATERS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for tankless, instantaneous- and storage-type electric, gas, and oil-fired hot water heaters, both household and commercial.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Design the plumbing system for safety, longevity, durability and flexibility.

The setpoint temperature for water heaters must be 120°F for general service and 140°F for kitchen dishwasher preheat. Provide mixing valves to distribute water to fixtures at 110°F.

Provide a minimum of two central water heaters for dormitories.

Provide temperature and pressure gauges at the inlet and outlet of each water heater.

Provide a minimum of two central domestic water heaters for each laboratory facility, each supplying 75% of demand. Coordinate with the UNLV Facilities group for other types of facilities for number of water heaters.

Use circulated hot water piping system, dead ends to 20 feet.

Install lockable-type shutoff valve, with lock, locked in the open position between the expansion tank and cold water supply.

Provide a properly sized pressure and temperature relief valve for each domestic water heater.

Recirculating pumps in domestic water heating systems must be of stainless-steel construction.

SUBMITTALS

Product Data: Include performance data, operating characteristics, furnished specialties and accessories.

Pressure Drop Curve: Submit pressure drop curve for flows ranging from 0 GPM to maximum value of water heater.

Shop Drawings: For water heaters, water heater trim and accessories, include:
- Elevations, sections, details
- Wiring Diagrams for power

Operation and Maintenance Data: Data to be included in water heater emergency, operation and maintenance manuals.

Warranty: Standard warranty specified in this Section.

Made in America Certification

Other Informational Submittals.
- ASME Stamp Certification and Report

PRODUCT STANDARDS

ASME Compliance: Condensing water heaters must be constructed in accordance with ASME Water heater and Pressure Vessel Code, Section IV (HLW) Potable Water Heaters.

ETL Compliance. Condensing water heaters must be tested for compliance with ETL, "Commercial-Industrial Gas Heating Equipment." Condensing water heaters shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

CO Emission Standards. When installed and operated in accordance with manufacturer's instructions.

Standard Warranty: Water heaters shall include manufacturer's standard form in which manufacturer agrees to repair or replace components of water heaters that fail in materials or workmanship within specified warranty period.

Warranty Period for Condensing Water heaters:
- The heat exchanger coil shall carry a 10 year from commissioning, non-prorated, limited warranty against any failure due to waterside corrosion, mechanical defects, or workmanship. The heat exchanger coil shall carry a 10 year from commissioning, non-prorated, limited warranty against any failure due to condensate corrosion, thermal stress, mechanical defects, or workmanship.
- Manufacturer labeled control panels are conditionally warranted against failure for two (2) years from commissioning.
- All other components, including the electronic igniter and electrode, are conditionally guaranteed against any failure for 24 months from commissioning.

MANUFACTURERS

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

High-Recovery, High-Efficiency Gas Water Heaters
- AO Smith
- PVI High-Recovery, High-Efficiency Electric Water Heaters
- AO Smith
- PVI Instantaneous Electric or Gas Water Heaters
- Rinnai
- Intellihot
- Bosch

CONSTRUCTION

Description: Water heater shall be direct fired, fully condensing, water-tube design. Power burner shall have full modulation. The minimum firing rate shall not exceed 30,000 BTU/HR input. Water heaters that have an input greater than 30,000 BTU/Hr at minimum fire will not be considered equal. The water heater shall have the capability of discharging into a positive pressure vent. Water heater thermal efficiency shall increase with decreasing load (output), while maintaining set point. Water heater shall have an operational set point capability of 100 ºF to 185 ºF and shall maintain the outlet temperature within an accuracy of +/- 4 ºF during load changes of up to 30% rated capacity. Water heater shall be factory-fabricated, factory-assembled and factory-tested, water-tube condensing water heater with heat exchanger sealed pressure-tight, built on a steel base, including a sealed insulated sheet metal enclosure that acts as combustion-air intake plenum with a built in serviceable air filter

ASME Rated Heat Exchanger: The heat exchanger shall be constructed with 316L stainless steel helical water tube, fully floating with no welded joints in the exchanger. The exchanger will have a single-pass unitary design (no separate primary and secondary heat exchanger). The water tubes shall be 0.75" ID, with no less than 0.0472" wall thickness. The heat exchanger shall be ASME Sect IV (HLW) stamped for a working pressure not less than 160 psig.

Modulating Air/Fuel Valve and Burner: The water heater burner shall be capable of a - 10-to-1, turndown ratio of the firing rate without loss of combustion efficiency or staging of gas valves. The burner shall be stainless fiber mesh covering a stainless steel body with spark ignition and flame rectification. All burner material exposed to the combustion zone shall be of stainless steel construction. There shall be no moving parts within the burner itself. A modulating air/fuel valve shall meter the air and fuel input. A variable frequency drive (VFD), controlled pre-mix blower shall be used to ensure the optimum mixing of air and fuel between the air/fuel valve and the burner.

The exhaust manifold shall be of polypropylene with a 6" diameter flue connection.

Ignition: Ignition shall be via spark ignition with 100 percent main-valve shutoff and dual electronic flame supervision.

CONDENSATE

Condensate traps, manufactured from only non-corrosive materials.

VENTING

The exhaust vent must be PVC, CPVC, Polypropylene, Stainless Steel (AL29-4C) compatible with positive pressure, condensing flue gas service, as required by the submitting manufacturer.

The minimum exhaust vent duct size for each water heater is six-inch diameter.

Combustion-Air Intake: Water heaters shall be capable of drawing combustion air from the outdoors via a metal or PVC duct connected between the water heater and the outdoors.

Common Vent and Common Combustion Air up to 4 units. Consult manufacturer for common vent and combustion air sizing. A submittal showing that the manufacture agrees to the submitted flue material, layout and installation path.

CONTROLS

Refer to Division 15990, Section "Controls."

The control panel shall consist of one individual circuit. The circuit boards shall include:

- A Digital touch display to indicate temperature and status.
- A CPU board housing all control function. Each board shall be individually field replaceable.

The combustion safeguard/flame monitoring system shall use spark ignition and a rectification-type flame sensor.

The water heater control system shall be a masterless cascading design with no-master - slave designation. The entire system shall have built-in usage optimization routine. I absence of this the contractor and engineer is to establish an in kind control system interface utilizing hard wired point to a UNLV BAS level controller programmed as described in the following Water Heater Management section.

Water Heater Management: the water heater control system shall incorporate onboard multi-unit sequencing logic that would allow masterless cascading (Not Lead/Lag) functionality & sequencing between multiple water heaters operating in parallel and must have the following capabilities:

- Efficiently sequence 2 up to 16 (~3,000,000 Btu) heat exchangers on the same system to meet the load requirement.
- Individual heat exchanger logic to enable accurate temperature control.
- Operate one motorized valve per heat exchanger as an element of the load sequencing, Valves shall close with decreased load as heaters turn off, minimum of one (depending upon Mode selection) must always stay open for recirculation.
- Automatically rotate Start/Stop amongst the heat exchangers in the chain based upon an internal calculation of run hours, water through put, burner starts and stops and length of time each burner has been firing. Sequencing is not based upon next in line (Lead/Lag), it is based upon the most logical (least used) heat exchanger in an effort to equalize unit run hours.
- Automatic bump-less transfer of sequencing in case of heat exchanger failure. All systems must be able to fail all but one heat exchanger in any order or for any reason and the last will continue to operate.
- Each heat exchanger will default to individual control upon failure of the sequencing chain.
- Automatic isolation of heat exchanger module from water circuit in case of failure and prevention of cold water from exiting the system
- Masterless control, change any parameter in any one of the units and all the rest in the series will automatically adjust to the most recent parameter change.

QUALITY CONTROL

ASME Compliance: Condensing water heaters must be constructed in accordance with ASME Water heater and Pressure Vessel Code, Section IV (HLW) Potable Water Heaters.

Perform tests and inspections and prepare test reports.

- Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies and equipment installations, including connections, and to assist in testing.

Tests and Inspections

- Installation and Startup Test: Perform installation and startup checks according to manufacturer's written instructions.
- Leak Test: Perform hydrostatic test. Repair leaks and retest until no leaks exist.
- Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion, if necessary.
- Controls and Safeties: Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
    - Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
    - Set field-adjustable switches and circuit-breaker trip ranges as indicated.

Remove and replace malfunctioning units and retest as specified above.

Occupancy Adjustments: When requested within 2 months of date of Substantial Completion, provide on-site assistance adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

Performance Tests
The water heater manufacturer is expected to provide partial load thermal efficiency curves. These thermal efficiency curves must include at least three separate curves at various BTU input levels. If these curves are not available, it is the responsibility of the water heater manufacturer to complete the following performance tests:

- Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
- Water heaters shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.
- Perform field performance tests to determine capacity and efficiency of water heaters.
- Test for full capacity.
- Test for water heater efficiency at low fire and 80 percent of full capacity. Determine efficiency at each test point.
- Repeat tests until results comply with requirements indicated.
- Provide analysis equipment required to determine performance.
- Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.
- Notify Architect in advance of test dates.
- Document test results in a report and submit to Architect.

END OF SECTION

SECTION 15487

HEAT EXCHANGERS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for steam, hot water, instantaneous, and storage-type water heaters.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Design the plumbing system for safety, longevity, durability and flexibility.

Domestic hot water generators must be double wall.

SUBMITTALS

Submit the following design and certification documentation:

Designer Submittals
Submit domestic hot water load calculations for:
- Building domestic hot water heaters
- Kitchen booster hot water system
- Laundry hot water system

Product Certificates Signed by Manufacturer
Specify that water heaters be inspected by the manufacturer's authorized representative who shall submit a written report to the engineer with copy to UNLV stating that the water heaters have been properly installed, are operating correctly, and the installation is acceptable to the manufacturer in every respect.

PRODUCT STANDARDS

Products must conform to the following standards:
- ASHRAE90.lb
- ASME

Manufacturers
Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

Instantaneous Steam Water Heaters
- Leslie
- Armstrong

Semi-Instantaneous Steam Water heaters
- Patterson-Kelley
- Leslie

INSTALLATION GUIDELINES

Provide pull space for coils.

Provide a 2' minimum clearance around the units for maintenance.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section.

Verify that the systems and equipment identified in this section of the standards and listed in the project specifications do not conflict with commissioning procedures for testing and training.

SECTION 15510

HEATING BOILERS AND ACCESSORIES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for heating boilers.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Select boilers/pumps for 100% to 120% of design load (two boilers at 50% to 60% capacity each).

Non-Condensing Boiler Option
- Utilize high efficiency gas-fired copper fin-tube boilers (87% minimum combustion efficiency).
- Design/calculate heating water system utilizing a 180°F hws temperature.
- Select pumps for a minimum 20°F temperature difference (30°F is typically appropriate).
- Utilize primary/secondary pumping (vfd's on secondary pumps)
- Provide stand-by pump for secondary heating water system (and in some cases for primary pumps).

Condensing Boiler Option with Allowance for Variable Primary Flow Designs
- Utilize high efficiency gas-fired copper fin-tube boilers (95% minimum combustion efficiency).
- Design/calculate heating water system utilizing a 130°F to 140°F hws temperature.
- Select pumps for a minimum 20°F temperature difference (30°F is typically appropriate).
- Utilize primary/secondary or variable primary flow pumping (vfd's on secondary pumps)
- Provide stand-by pump for secondary heating water system (and in some cases for primary pumps).

Equip boilers with BACnet communication interface to provide at minimum contacts for remote start/stop, HW temperature set point and alarm status.

Provide for HWS reset capability based on OA temperature

Boilers shall be designed and constructed in accordance with ASME Boiler & Pressure Valve Code Section IV and designed for 250 degrees F and 160 psig.

Burners shall be designed for full linear modulation with a minimum 5:1 turndown.

The waterside pressure loss through the boilers at rated load shall not exceed 4psiThe boiler shall have a factory installed insulation with metal jacket. Minimum of 2" thick fiberglass or mineral wool insulation. Jacket to be 18 gauge, painted steel with heat resistant primer and finish coats.

Provide ASME safety valve(s).

Each boiler shall be equipped with a combination feeder and low water cut-off.
- Low water cut-off shall be float type with manual reset.
- Each boiler shall be equipped with a manual reset type high temperature limit control.

The specifications for projects including a boiler shall require that the contractor apply for and obtain all required boiler inspections and operating permits (as required by the Nevada Industrial Relations Division, Occupational Safety and Health Enforcement Section, the contractor shall obtain an installation application prior to beginning any work and shall apply for a final inspection as required to obtain the boiler operating permit). Reference NRS 455C.

All new gas burners on boilers will have an IRI (Industrial Risk Insurers) approved gas train.

SUBMITTALS

The boiler schedule should include the following information and/or options: List the required minimum boiler efficiency, contacts for remote start/stop, contacts for remote monitoring of alarm/failure status, and list the desired/required pressure relief valve pressure rating.

Approved manufacturers
- Camus
- Patterson Kelley
- Thermal Solutions
- Weil-McLain
- RBI

END OF SECTION

SECTION 15515

WATERTUBE BOILERS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contained design criteria for water tube boilers. Water tube boilers are an outdated form of heating and thereby not defined nor supported by the UNLV Facilities Management Division.

Should a consulting engineer wish to use a water tube boiler, they will need to submit the value and need to UNLV Facilities Management Division for consent and acceptance of any such technology.

SECTION 15540

HVAC PUMPS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for HVAC Pumps.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Pumps

Water pump assemblies shall be vertical inline pumps with outside balanced seals. Base mounted pumps are acceptable provided they are installed using concrete filled inertia bases, braided stainless steel piping isolation couplings, and certified laser alignment of the pump to motor shaft. Direct coupled pumps are allowed for pumps of 7.5 Hp or less, all others shall be split coupled. All pumps applications shall include a compound gage with manifold for determining pump performance. Split case type pumps are not acceptable.

Allowed Manufacturers - Subject to compliance with the design requirements, allowed manufacturers include, but are not limited to, the following:
- Bell & Gossett
- Armstrong
- Taco
- Aurora (Petra)
- Alternate manufactures must obtain written authorization from the UNLV facilities engineer(s) in consultation with the project design engineer; prior to bid of the project.

Pump Speed

Base mounted pumps shall not operate above 1750 rpm. Vertical inline pumps may operate above 1750 rpm.

Pump Motors

Motors driving pumps shall be sized for single pump operation, larger than the design operating point such that pump motor overloading cannot occur when not operationally controlled by a variable frequency drive. Motors with VFDs can be non-overloading with VFD over load protection in place. Motors with direct coupled VFDs are acceptable.

Backup Systems

All pumping equipment shall have a secondary backup system connected in parallel, with non-slam check valves in the discharge, and isolating valves for each pump. All connecting pipe, valves, fittings, etc shall be sized for design flow rates.

VERTICAL INLINE PUMP REQUIREMENTS

Provide Vertical In-Line (VIL) pumps, single stage, single or double suction type, with pump characteristics which provide rising heads to shut off. Refer to pump schedule for pump flows and heads and motor speed, enclosure, efficiency and power requirements and other system conditions.

Pump Construction: Pump Casing - Cast Iron with 125 psig ANSI/PN16 flanges for working pressure below 175 psig (12 bar) at 150°F (65°C) and Ductile Iron with 250 psig ANSI/PN25 flanges for working pressures to 375 psig (25 bar) at 150°F (65°C). Suction and discharge connections shall be flanged and the same size and shall be drilled and tapped for seal flush and gauge connections.

Impeller - Bronze, fully enclosed type. Dynamically balanced. Two-plane balancing is required where installed impeller diameter is less than 6 times the impeller width.

Shaft: Provide Stainless Steel pump shaft.

Coupling - Rigid spacer type of high tensile aluminum alloy. Coupling to be designed to be easily removed on site to reveal a space between the pump and motor shafts sufficient to remove all mechanical seal components for servicing and to be replaced without disturbing the pump or motor.

- Close coupled pumps are only allowed for application of 7 1/2 HP or less.

Mechanical Seals - Shall be Stainless Steel multi-spring outside balanced type with Viton secondary seal, carbon rotating face and silicon carbide stationary seat. Provide 316 stainless steel gland plate. Provide factory installed flush line with manual vent.

All split coupled pumps shall be provided with a lower seal chamber throttle bushing to ensure seals maintain positively cooling and lubrication.

Seal flush line accessories, if required to improve seal chamber cleanliness: Supply in the flush line to the mechanical seal a 50 micron cartridge filter and sight flow indicator, to suit the working pressure encountered.

Filters shall be changed, by the installing contractor, after system is flushed and on a regular basis until turned over to the owner.

Alternately, a maintenance-free accessory needing pump differential pressures exceeding 70 ft./30 psig/200 kPa for effective operation: Supply in the flush line to the mechanical seal a maintenance-free sediment separator, with sight flow indicator.

BASE MOUNTED PUMP REQUIREMENTS

Furnish and install, as indicated on the plans and specifications, base mounted centrifugal pumps.

The pump shall be single, end suction type with radially split, top center-line discharge, self-venting casing. The casing-to-cover gasket shall be confined on the atmospheric side to prevent blow-out possibility.

Pump construction shall be cast iron, bronze fitted (all iron, all bronze, ductile iron) and shall be fitted with a long-life, product lubricated, drip-tight mechanical seal, with O-ring seat retainer, designed for the specified maximum temperature and pressure.

The shaft shall be fitted with a Stainless Steel shaft sleeve and be supported by two heavy duty ball bearings. The design shall allow Back Pull Out servicing, enabling the complete rotating assembly to be removed without disturbing the casing piping connections.

The pump shall be mounted on a rigid, single piece baseplate, with grouting hole, and connected by flexible coupling, with guard, enclosure squirrel cage, induction type motor of Federal approved efficiency level and suitable for across-the-line (wye-delta, part wind) starting.

The housing shall be hydrostatically tested to 150% maximum working pressure.

The unit shall be suitable for the conditions shown on the pump schedule.

END OF SECTION

SECTION 15545

CHEMICAL WATER TREATMENT

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for the Chemical Water Treatment.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Chemicals
Water treatment for all mechanical water systems shall be by San Joaquine Inc. Coordinate this requirement with UNLV Planning and Construction.

Initial Treatment
Initial water treatment shall be witnessed by representatives of the UNLV Office of Planning and Construction. Initial water treatment shall not be done before the system is cleaned in accordance with Specification 15510. Retesting of the system shall be completed every two weeks thereafter until the turbidity is within specified limits and is constant. If additional cleaning is required, it shall be at the expense of the contractor, and shall be completed by the installation of a side stream filter with a replaceable filter media section. Filters shall be provided by the contractor.

SECTION 15550

HEAT GENERATION

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for Heating Boilers.

DESIGN SYSTEM AND PERFORMANCE REQUIREMENTS

Boiler Tests

New boiler systems shall be tested by an independent third party for proper operation prior to issuance of substantial completion. Any deficiencies found by the test shall be corrected at no cost to UNLV. A flue gas analysis shall be completed for each boiler or domestic water heater that requires permitting and operating tests by Clark County or the State of Nevada Boiler Inspection Division, the results provided to UNLV Planning and Construction, and the statement that the results show the boiler," does or does not" meet the manufacturers or contract documents specified efficiency.

If the test shows the unit does not meet the specified efficiency, the contractor shall include in the report the reason(s), and provide the necessary corrections, and retesting. The boiler shall be replaced at the contractor's expense if the specified efficiency cannot be achieved prior to the beginning of scheduled boiler startup. Coordinate this requirement with UNLV Planning and Construction.

Electric Resistance Heating
The use of electric resistance heating methods for space heating is not acceptable.

SECTION 15625

CENTRIFUGAL WATER CHILLERS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for water chillers.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Select chillers based on performance, service and maintainability, and life-cycle costing.

Specify factory 2 point testing for each new chiller, witnessed by the Engineer and Owner. For single chiller plants provide testing at the 100% load and 25% load points. For 2 or more chillers provided testing at alternating load points (i.e. Chiller one tested at 100% & 25%; Chiller two tested at 75% & 50%). All costs for the testing including travel and lodging is to be included in the contractor pricing. All testing shall be in accordance with ASHRAE Standard 550/590. Added provisions for chillers above 500 tons; chillers will incorporate two additional point tests for zero tolerance test for full load tons and kw/ton for each chiller.

Variable primary flow chilled water system design is preferred and is to be implemented whenever possible.

Allowed Manufacturers: Subject to compliance with the design requirements, allowed manufacturers include, but are not limited to, the following:

- Centrifugal chiller types - Trane, Carrier and York
- Helical rotary chiller types – Dunham-Busch, Trane, Carrier and York
- Mag-Lev Chiller Types – Smardt; Daiken; Dunham-Busch, Multistack.
- Alternate manufactures must obtain written authorization from the UNLV facilities engineer(s) in consultation with the project design engineer; prior to bid of the project.

Energy-efficient centrifugal and mag-lev chillers should be selected at 0.50-.65 kw/ton at full load and approximately 0.4 kw/ton at partial load. Helical rotary chillers should be selected at 0.62-0.72 kw/ton and air cooled chillers at 0.7-0.78 kw/ton.

Size two chillers for 70% of the load and pipe them to cross feed with their own and the other chiller's tower.

Mechanical room designs: Design supplemental mechanical room cooling systems to maintain ambient temperatures in chiller mechanical rooms to 85°F to 65°F. Design to the latest ASHRAE 15 standard as regulated by the latest code requirements.

Provide a system design that can accommodate minimum and maximum loads without the use of a plate and frame heat exchanger for waterside economizing.

Pipe chilled water circuits in a parallel or headered (not direct coupled) configuration for complete functional flexibility. Provide automatic on/off valves where necessary to avoid pumping through an inoperative chiller.

Chillers shall use either R-134a or R-514 refrigerants. Alternative refrigerants may only be used on a case my case basis and only after written authorization has been given by UNLV engineering in consultation with the engineer of record.

Noise and vibration must be taken into consideration for chiller location and isolation bases and mounting systems. Noise transmission into adjoining spaces to the mechanical room must be lower than 35 NC levels. No more and 5% translational vibration from one room to the next is allowed as measured by a calibrated potentiometer at the base of the chiller(s) housekeeping pad.

Central air conditioning systems for a building or group of buildings must be served by two or more chillers whenever possible.

SUBMITTALS

Submit the AHRI certified design, testing, and certification documentation to include: Tonnage; GPM flow rates; Water flow pressure drops; Condenser & evaporator water pressure drop; Data required to confirm compliance with plan and project documentation.

The chiller schedule should include the following information and/or options:
The required minimum chiller full load efficiency and the Non-integrated Part Load Value (NPLV), the required refrigerant (R-134a or R-514 are acceptable), BACnet MS/TP interface for remote communication with DDC control system, contacts for remote start/stop and for remote monitoring of alarm/failure status, capability to unload to 15% of maximum capacity, suction service valves, and compressor sound blankets for chiller(s) with sound levels at or above 80DdBA.

Product Certificates Signed by Manufacturer
Specify that chillers be inspected by the manufacturer's authorized representative who shall submit a written report to the engineer with copy to UNLV stating that the chillers have been properly installed, are operating correctly, and that the installation is acceptable to the manufacturer in every respect.

ACCESSORIES OR SPECIAL FEATURES

Refrigerant pressure relief valves: provide frangible or spring resettable refrigerant pressure reliefs valves for all low pressure refrigerant chillers (i.e. R-514). For all high pressure refrigerant chillers (R-134a), only resettable pressure relief valves are acceptable.

Hinged water boxes: chillers larger than 500 tons, specify the installation of hinged condenser water boxes and grooved piping to simplify the removal of the heads for cleaning.

Flow proving switches: Equip all chillers with dispersion flow proving switches wired to prevent the compressor from starting until chilled water flow has been established. Dispersion flow sensors are preferred, if paddle type flow switches are used, they are to be installed with no less than 6 (six) pipe diameters free linear clearance between any piping joint or flow obstruction up and downstream of the switch . Paddle switches are not to be trimmed to fit within the piping.

Safety Cut-Outs: All safety cut-outs must be manual reset types. Provide time delay for all machines.

Head pressure control valve: provide a 3-way condenser water head pressure controller for water cooled chillers. The 3-way valve is to be controlled by the chiller.

QUALITY CONTROL TESTING

Specify a factory test with the engineer and a UNLV witness to verify performance kw/ton at design operating conditions and at integrated part load value (IPLV).

INSTALLATION GUIDELINES

Allow sufficient clearance and access in building construction for replacement chillers and parts, and for normal chiller maintenance. Provide clearance as required by the chiller O&M documents, and no less than 3ft clearance to the sides of the chiller and 4ft clearance above the compressor to allow for the use and manipulation of a gantry system.

In new construction, the central plant shall be designed with temporary or emergency chiller connections. Connections to include evaporator and condenser water connection points complete with isolation valves and capped a future machine and accessories equal in size to the largest machine being furnished. In existing buildings or plants, it is sufficient to dot-in future building expansion, if necessary, to provide the space for the future machine. In either case, space must be designated for the future starter, pumps, and cooling tower.

Locate chiller plants at grade level for ease of servicing. Size, arrange, and valve the plant piping for installation of the future chiller, pumps, cooling tower, and other equipment.

Allow sufficient clearance for tube bundle pulling and cleaning.

Provide marine boxes and piping to facilitate head removal.

Do not install chillers in the same space as fuel-firing equipment, such as boilers and water healers.

Arrange chilled and condenser water piping with offsets for flexibility. Adequately support and brace the piping independently of the chiller to avoid strain on the unit.

Install each water pipe connected to a chiller with a flexible connection, as necessary for seismic conditions. See Section 00200: Information Available to Designers for seismic requirements.

Use a flexible connection at least 24" long to make all water chiller electrical connections.

Use vibration elimination hangers to hang all piping connected to chillers.

The contractor is responsible for the notification of all sections or individuals identified by the project manager at least three days prior to disruption of utilities.

The contractor will provide a 24-hour emergency telephone number that will be maintained at the Physical Plant Control Center or the UNLV Utilities Department.

During installation, the contractor must have personnel available for immediate response in case of emergency (for example, broken pipes or interrupted electricity).

Testing of the chilled water system must be accomplished with the Physical Plant mechanics, and when specified, requires certification from an independent testing company.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section.

Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

END OF SECTION

SECTION 15635

REFRIGERANT DETECTION AND ALARM

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for refrigerant monitoring and safety equipment.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General requirements include showing the locations of utility service connection points, verifying the capacity of these connection points, and installing equipment in a safe, well-lit, and accessible location.

Verify emergency power for refrigerant monitoring and ventilation equipment.

The detector status shall report to the campus EMS.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section.

Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

SECTION 15640

COOLING TOWERS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for open-circuit, mechanical draft cooling towers.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Cooling towers to be designed and constructed in accordance with the Cooling Tower Institute and CTI 201.

Cooling towers to be either cross flow or counter flow design, 2-call, induced flow type designed for outdoor use with all-around 316 stainless steel construction with PVC fill and mist eliminators. Low noise axial fan with V-belt drive. Towers systems to include conductivity controller to blow down valve. Where exposed to freezing conditions, cold water basin to have electric basin heaters.

Cooling tower basin shall be equipment with a basin cleaning system consisting of PVC piping and nozzles. A tower filtration system for the condenser water system shall be provided in a form of full-flow Spirotherm air/dirt separator with automatic drain valve and manual by-pass valve. Flame spread of all materials used shall be 25 or less.

General requirements include showing the locations of utility service connection points, verifying the capacity of these connection points, and installing equipment in a safe, well-lit, and accessible location.

Size towers for 70 percent of the load, and pipe them to cross-feed with the other towers.

Locate the cooling tower so that spray or plume, which can be a source of Legionella, cannot enter outdoor air intakes.

Consult the tower manufacturer for the octave band sound power ratings of the tower and for assistance in sound evaluations. An analysis of the proposed cooling tower relative to adjacent occupancies must be made considering noise, fan horsepower, and the cost of alternative cooling tower selections. The 60 dBA requirement at 120 feet in Section 00700: General Design Conditions, may be changed for particular projects (lower for critical locations, which may also require attenuation, and higher for non-critical locations).

Verify that the tower is located such that condenser pumps have sufficient net positive suction head (NPSH).

Provide water treatment for cooling towers, and show the location of the equipment on the drawings.

Treatment chemicals may be put into the return piping if the feed pump is interlocked with cooling water flow.

Cooling towers for systems that are not to be drained in winter must be winterized for automatic winter operation.

If a cooling tower by-pass is provided, the by-pass must discharge to the cooling tower basin(s) rather than to the outlet piping.

Provide for hoist beams overhead so that the condenser and chiller heads can be removed.

Piping to refrigeration equipment must be supported independently. Piping to chillers must include offsets and mechanical couplings or flanges to permit removal of heads and tubes.

Cooling Tower Water Treatment
Provide a chemical treatment system with tanks, pumps, piping and controls. EPA approved dual biocides for microbiological control. The following criteria must be met:

Biological control of both bulk water and under deposit bacteria. The program components must be EPA registered as a biocide and be known to be effective against Legionella. Our maximum counts for open systems are 10,000 cells/ml or less for total aerobic; 50 cells/ml or less for anaerobic in the bulk water; and no Legionella.

Scale Control
This is normally accomplished with a combination of polymers & phosphonates. The LSI's should be calculated at various cycles and the program limitations identified. The highest skin temperatures are used in this calculation.

Corrosion Control
This is normally accomplished with a combination of the waters naturally scaling tendencies (hardness + alkalinity) and then modified as necessary using phosphates, zinc, molybdenum, etc. for mild steel. Azoles are used for copper corrosion control. Our acceptable corrosion rates are 1.0 mils/yr or less for mild steel and 02 mils/yr or less for copper. Provide for storage tanks, positive displacement metering pumps and piping for two alternating biocides and two corrosion inhibitors on cooling tower condenser water circuit.

Manufacturers
- Marley
- Baltimore Air Coil
- Evapco

MATERIALS

Use stainless steel drain pans for long service life and to help in restricting microbial growth.

QUALITY CONTROL

Product Certificates Signed by Manufacturer
Specify that cooling towers be inspected by the manufacturer's authorized representative who shall submit a written report to the engineer with copy to UNLV stating that the cooling towers have been properly installed, are operating correctly, and the installation is acceptable to the manufacturer in every respect.

Testing
Biweekly testing and written reports by the vendor for a period of one year from building occupancy, at no cost to the University, of condenser water with the following testing and data; conductivity, M alkalinity, pH, iron, copper, chlorides and microbiological counts (anaerobic species and identification of species). Also, install steel, copper, and galvanized steel (or 304ss) coupons in a 4-position rack. Examine, weigh and replace coupons every ninety days. Also, the vendor must have a plan and demonstrate passivation of the cooling tower surfaces over a 90-day break-in period if galvanized. At the end of one year of continuous services the vendor shall perform a borescope inspection of the chiller condenser bundle with

photographs showing tube surfaces.

INSTALLATION GUIDELINES

Install davits, beams, or other means for assisting in the removal and replacement of tower motors larger than IS hp.

For multiple tower installations, provide for equalizing pipe, and provide balancing valves in the supply and return piping.

Valve each tower separately for servicing.

Provide for sufficient free and unobstructed space around the tower per manufacturer recommendations to ensure adequate air supply.

Do not locate towers downstream of boiler stacks or upstream and near to outdoor air intakes.

Install tower piping to allow for expansion and contraction flexibility between the tower and piping.

The cooling tower must be located to avoid problems with noise, vibration, air recirculation or drift.

Provide security and maintenance lights and receptacles for maintenance at the cooling tower. When access to the tower is greater than 7 feet above grade, provide structural ladder and platform to enable access to the access doors in the cooling tower sidewalls.

The cooling tower where required, shall have an OSHA-compliant handrail around the top and/or side where access is necessary and cage ladder to all platforms. Permanent access from grade to the platform shall be provided.

At stations where Cottonwood or similar types of trees are likely to interfere with cooling tower operation, provide easily-cleaned screens or roughing filters at the air inlets.

Consider how several drums of chemicals with spares might be moved to and from the point of use

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section.

Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

SECTION 15650

REFRIGERATION

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SUMMARY

This section contains design criteria for Refrigeration Producing Equipment.

DESIGN SYSTEM AND PERFORMANCE REQUIREMENT

Buildings Over 20,000 Square Feet
Large central chiller systems shall be used on buildings larger than 20,000 gross square feet. Consideration shall be given for using a looped chilled water/hot water distribution system with an existing building.

Buildings Under 20,000 Square Feet
Water source heat pumps or roof mounted packaged AC units may be considered for buildings under 20,000 gross square feet.

Refrigerant
All new refrigeration equipment shall use refrigerant having a “Refrigerant Safety Group Classification of A-1”, as defined by ANSI/ASHRAE Standard 34=1997, for example HFC-134a. Refrigerant type HCFC-22 may be used with written permission form UNLV Office of Planning & Construction. All other refrigerant types are not acceptable.

Water Source Heat Pumps
The compressors for water source heat pumps shall be stacked or located in mechanical rooms for easy access. Adequate space shall be provided around each unit to allow monthly replacement of filters and repair or replacement of the unit without removal of building walls or fixtures that are not part of the equipment installation. These units shall be located so they do not violate the OSHA mandated clearances in front of electrical equipment. Water source heat pumps mounted above the ceiling are not acceptable. Any changes required for new installations to comply with these requirements shall be done at no cost to UNLV.

Package AC Units
The compressors for package AC units shall be located for easy access. Adequate space shall be provided around each unit to allow monthly replacement of filters and repair or replacement of the unit without removal of building walls or fixtures that are not part of the equipment installation. These units shall be located so they do not violate the OSHA mandated clearances in front of electrical equipment. Any changes required for new installations to comply with these requirements shall be done at no cost to UNLV.

The placement of any packaged DX equipment inside a room or enclosure, that results in the space being considered a “Refrigerant Equipment Room”, shall have the refrigerant piped to the exterior for venting, and shall be provided with the emergency ventilation fans, alarms, electrical shut-off/on switches and make-up air systems as defined in ASHRAE Standard 15-2001. All refrigerant equipment shall be installed per the manufacturers recommends unless this conflicts with local codes, including refrigerant relief vent piping. Coordinate a safe discharge location with UNLV Planning and Construction.

Cooling Towers
Cooling towers shall induced draft counter flow type with sound reducing nozzle, and be constructed of ceramic, fiber-glass, or stainless steel materials and built for institutional purposes. All cooling towers should have variable frequency drives, and be provided with anti-vortex strainers, makeup water stilling chambers, low loss media, drift eliminators, nozzle basin covers, a cold water basin scrubber, and vibration cut-off switches capable of being monitored by the UNLV EMS.

Acceptable manufacturers are:
- Baltimore
- Marley
- Evapco
- Approved equal

Cooling Tower Sizing
Cooling towers shall be sized for the larger of chiller load or tower free cooling load.

SECTION 15672

AIR-COOLED CONDENSERS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for air-cooled condensers and condensing units.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Units must consist of coils with integral sub-cooling, and casings with stands.

Coil must be aluminum plate fins on mechanically-expanded copper tubes. Coils must be cleaned, dehydrated, sealed, leak tested at 150 psig, and pressure tested at 420 psig.

Fans must be direct-drive, propeller fans protected with guards.

Condensers must have two, 3-phase motors and one permanent split capacitor motor for use with accessory speed controls suitable for reduced-voltage starting. Motors must be pre-lubricated, with built-in overload protection.

Fan shafts must be corrosion-protected. Fan blades must have an irradiate or aluminum finish. Magnetic contactors must be field-supplied. Provide magnetic contractors in accessory fan cycling control packages to cycle fans in response to the outdoor ambient temperature.

Casings must have baked enamel finishes. Provide access panels for electrical connections.

Provide openings for power and refrigerant connections.

Condensers must have low ambient operating capability and controls.

INSTALLATION GUIDELINES

Locate the condenser or condensing unit away from side and overhead restrictions. Maintain at least a one-half length or full-width distance from side restrictions, or as directed by the manufacturer. Overhead clearance should not restrict the full discharge of hot air.

Do not locate the discharge near outdoor air intakes.

Mount air-cooled condensers on grade on a concrete pad that is 6" larger all around than the condenser. The bottom of the pad should be carried below the frost line.

When mounted on the roof, a steel framework should be erected. Install vibration pads between the structural framework and the condenser supports.

Do not install the condenser or condensing unit in locations where the coils can become plugged, such as near cottonwood trees or in locations where construction is to take place in the near future. When not possible, provide easily-cleaned screens or roughing filters at the air inlets.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

SECTION 15710

HYDRONIC AND STEAM HEAT EXCHANGERS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for shell and tube heat exchangers and for plate and frame heat exchangers.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Shell and tube heat exchangers are typically used for heating. Plate and frame heat exchangers are used for cooling applications.

The engineer must ensure that no cross-contamination occurs and that the materials are suitable for service.

Design heat exchanger piping so that the heat exchanger can be backwashed. Include a floor drain of sufficient size to accommodate the backwash.

Provide separate heat exchangers for reheat and for perimeter heating systems.

Provide safety pressure relief valves on both sides of the unit between the heat exchanger and shut off valves to guard against thermal expansion when the unit is not in service and to protect against over-pressurization. Provide relief valves on heated fluid connections. Install relief valves full size of valve connection to floor drain.

Maintain manufacturer-recommended clearances for service and maintenance.

Provide piping connections to facilitate heat exchanger service and maintenance.

Provide shutoff valves at heat-exchanger inlet and outlet connections.

Provide a vacuum breaker at the heat exchanger steam inlet connection.

Provide a hose-end valve to drain the shell.

PRODUCT STANDARDS

ASME Compliance
Fabricate and label heat exchangers in compliance with the ASME Boiler and

Pressure Vessel Code, Section VIII: Pressure Vessels, Division 1.

Registration
Fabricate and label shell and tube heat exchangers in compliance with Tubular Exchanger Manufacturers Association standards.

Manufacturers
Subject to compliance with the design requirements, provide products by one of the following

manufacturers:
Shell and Tube Heat Exchangers—Heating and Steam-to-Hot Water Applications

- ITT Industries
- Bell and Gossett
- Armstrong Pumps, Inc.
- Bryan Steam Corp.

Gasketed Plate and Frame Heat Exchangers—Chilled Water Applications)

- Alfa Laval
- Tranter PHE, Inc
- ITT Industries
- API Heat Transfer Inc.

Special Requirements

All heat exchangers must have a pressure rating of at least 125 psig for both the shell and tube bundle, even if the operating pressures are less. For high-pressure applications (above 15 psig), the shell and head must be rated for the maximum steam temperature available at the building location.

Equip the shell with an ASME-approved pressure/temperature relief device, piped appropriately.

Pipe and test heat exchangers using high pressure steam in accordance with the ASME Power Piping Code. Hydrostatic tests are required of all high-pressure components, inclusive of tests across closed valves (leakage tests). Both high- and low-pressure exchangers must be ASME-rated.

INSTALLATION GUIDELINES

Install glycol heat exchangers only in mechanical rooms.

Pipe heat exchangers to enable easy venting.

Provide service access with sufficient clearance for draining.

Provide sufficient pull space for shell and tube heat exchangers.

For plate and frame heat exchangers, provide sufficient space for adding and removing plates.

Coordinate plate and frame heat exchanger bolt extensions with nearby piping and equipment.

Heat exchanger backwashing must be accomplished without dismantling the unit and by just adding a hose.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

SECTION 15725

CENTRAL STATION AIR-HANDLING UNITS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

A. This section contains design criteria for air handling units.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

A. Provide each plenum with a trapped condensate drain piped to an open waste. The trap seal must be deep enough to withstand system pressures—positive or negative at the trap inlet—and maintain trap seal. Allow l" to drain.

B. When final filtration is provided in an air handling unit downstream from the cooling coils, make provisions to avoid wetting the filters. Carefully evaluate blow-through units in this application.

C. Air handling unit supply and exhaust air fans serving laboratories are redundant.

SUBMITTALS

A. Submit calculations for air handler airflow and pressure sizing.

B. The manufacturer's representative must check air handling units of 25 hp and over for proper installation, alignment, belt tension, and operation. File a written report with the engineer, and provide a copy to UNLV. The report must state that at the time of the report the fan is running properly and is acceptable to the manufacturer in every respect.

C. Provide sound-level data by octave band, as required by the specifying engineer.

WARRANTY

A. Manufacturer warrants each product to be free from defects in material and workmanship under normal and proper use, and will within twelve (12) months from date of startup and not exceed eighteen (18) months from shipment, repair or replace any part which proves to be defective. This warranty is to include labor and service charges that occur under this warranty period. Minimum (5) five-year compressor warranty shall be provided, parts only.

MANUFACTURERS

A. Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include the following list of manufacturers for a given AHU function and use. All other manufacturers seeking approval to bid must get written approval from the engineer, in consultation with the UNLV Facilities & Maintenance department, prior to submitting any price for the project.

B. Modular (Catalogued) Air Handling Units, does not preclude the use of the custom manufacturers
   1. Carrier
   2. Trane
   3. York

C. Custom Hydronic Coil Air Handling Units
   1. Annexair
   2. Alliance Air Products
   3. Temptrol
   4. Seasons4

D. Custom DX Cooling, Heat Pump, or Energy Recovery Air Handling Units
   1. Annexair
   2. Temptrol
   3. Scott Springfield
   4. Seasons4

MATERIALS

A. Structural Criteria
   1. Units must conform to the structural provisions of the BOCA code (with Connecticut addendum), including but not limited to, snow load, seismic forces, and lateral wind loads.

B. Base
   1. The base must consist of steel beams or channels for direct bearing support of the steel floor and major components in the casing. Base structure shall be fully welded G-90 floor insulated with R12 foam shall be mechanically fastened to the base structure which shall consist of an anti-vibration gasket to diminish the metal to metal contact, painted exterior, and have integral lifting lugs which can be removed once the unit is installed.

C. Coil Drain Pan
   1. The main drain pan must extend beneath the entire cooling coil, including the coil pipe header and return bends in the airway. The main drain must extend a minimum of 18" downstream of the coils.
   2. The main drain pan must be 16-gauge stainless steel, continuously welded to form a watertight basin. The sides must be at least 4" high, with threaded 2" half-couplings welded to one side for drainage.
   3. Provide intermediate drain pans beneath each stacked cooling coil, extending a minimum of 12" downstream of the coil. These intermediate drain pans must have 2" sides and 1-1/4" stainless steel or copper vertical leader pipes to the bottom pan. Provide dielectric fittings between different materials.
   4. Avoid the use of condensate pumps; the preferred method is gravity drainage. For gravity drainage and efficient removal of condensate, air handling units must be installed with sufficient elevation to allow for required condensate trap and piping runout clearances to drain.

D. Humidifier Drain Pan
   1. Provide a 16-gauge stainless steel drain pan beneath the humidifier section, with 2" sides and fully welded seams. Provide 2" drain piping from the sloped pan to the unit floor drain.

E. Walls, Partitions, and Roof Structure
   1. The panels shall be tested in accordance with SMACNA and ASHRAE 111 to have a deflection of no more than L/1150 at 10’’ and withstand air pressures up to 8” w.c with less than 1% leakage. Fire resistance of the panel will be in compliance with UL 94 rated at 5VA; and a flame spread / smoke development in compliance with UL 723 ASTM E84 Class 1 rating.
   2. All roof and wall panels shall be made with either a 2” Thermo-composite and foam panel or 4” G-90 galvanized steel and mineral wool insulation, minimum 18-gauge exterior and 20 gauge interior. The frame shall consist of post and panel construction utilizing anodized extruded aluminum profiles which incorporates a thermally broken construction; welded together for reinforcement and insulated for superior thermal performance. Panel only construction is not

allowed due to a reduction in overall unit strength and integrity should panel removal be required to service and maintain internal components.

3. All panels and access doors shall be double wall construction with R14 foam insulation. All foam insulation must be Greenguard certified®. Any insulation incorporating CFCs or HCFCs in its construction is strictly prohibited.
4. Access doors shall be provided to all major components to facilitate quick and easy access. Access doors will be made from the same material as the unit casing and shall incorporate thermal break construction. Fan access door(s) shall have Allegis type handles, with one handle interlinking multiple latches and threaded insert fastening handles for all remaining doors. If access doors do not open against unit operating pressure, provide safety latches that allow access doors to partially open after first handle movement and fully open after second handle movement. Removable panels provided for equipment pull out for coil(s), and air to air heat exchanger section(s) shall have key tooled threaded insert fasteners. Hinges shall be Nylon hinge type designed to open 180 degrees.
5. Base structure shall be fully welded G-90, painted exterior, and have integral lifting lugs which can be removed once the unit is installed.
6. The air handler unit casing shall be provided with a lifetime warranty against corrosion resistance under normal use.
7. Provide sufficient room for removal of the fan and fan shaft from the air handler.
8. Provide vapor-tight, marine-type incandescent lighting fixtures in each air handling unit compartment (and outside the unit on each side, if it is an exterior unit).
9. Provide galvanized, rigid-steel conduit from the fan motor through the casing wall. Use liquid-tight, flexible-steel conduit for the connection to the fan motor. Rigid conduit must be fixed to the casing and must not interfere with operation or access.
10. Provide two empty, rigid-steel conduit sleeves at each compartment for ATC wiring and air tubing. Conduit sleeve locations of the must be coordinated by the testing, adjusting, and balancing contractor.
11. Provide two weather-tight duplex receptacles on the exterior of the unit in appropriate locations. Circuit separately from the lights.
12. Provide a local disconnect switch for the fan motor, directly outside the fan enclosure.

HEAT RECOVERY WHEEL

A. ENTHALPY WHEEL

1. The enthalpy wheel shall recover both sensible and latent heat and be AHRI 1060 certified.
2. The matrix shall be a minimum of 8’’ thick to achieve optimal performance and be constructed from a corrugated aluminum alloy. The corrugation shall be uniform to obtain minimum pressure drops through the wheel. Wheels with varying flute sizes are not acceptable. Wheels with non-metallic matrices will not be considered for this application.
3. Wheels with varying flute sizes are not acceptable. Wheels with non-metallic matrices will not be considered for this application.
4. The media shall be specifically treated and coated with Silica Gel desiccant to assist and enhance latent heat transfer.
5. A heavy-duty wheel hub will contain the bearings in a closed compartment for wheel sizes up to 96’’ diameter. These shall be maintenance free while larger sizes require periodic lubrication. In addition, segmented wheel shall be provided on diameter sizes above 96’’.
6. The seal shall made from a dual band ultra-high molecular weight polyethylene and be self-lubricating, wear resistant, and air tight against prolonged use. Seals shall be full contact compression type, on both sides of the wheel to ensure minimal leakage. Specially designed stainless steel clips are used to position the seal across the face of the wheel. Any seal that is non-contact is not to be considered a seal and will not acceptable. Labyrinth type seals do not operate properly under different air stream pressures therefore shall not be acceptable in any circumstances.
7. Drive system shall be operated by a fractional horsepower motor (maximum 1 HP), reducing gear-box, pulley and V-belt. Belts shall be made of multi-link high-tech urethane/polyester

composite. An access panel shall be provided for maintenance on the drive system. A double purge sector (2 x 5º) shall be factory installed to reduce cross contamination to under 0.04%. Frost control prevention shall be provided by the unit manufacturer and accounted for if outdoor air temperatures are below 10°F at equal airflows and return relative humidity below 30%. Frost control shall be accomplished by a variable speed drive and controlling the leaving air condition of the exhaust air. Other methods of frost control will not be considered for this application. Wheel speed shall not rotate faster than 20 RPM. Any rotational speed above 20 RPM will be unacceptable since this will reduce the efficiency of the purge section.

8. Media cleaning shall be accomplished with any of the following methods: compressed air, low pressure steam, hot water or light detergent without degrading the latent recovery.

B. SENSIBLE WHEEL
1. Sensible Wheel shall recover sensible heat and be AHRI 1060 certified.
2. The matrix shall be constructed from corrugated aluminum.
3. Segmented wheel shall be provided on diameter sizes above 96”.
4. Seals shall be full contact, low bleed type, made from dual band Ultra High Molecular Weight Polyethylene. Any seal that is non-contact is not to be considered a seal and will not acceptable. Labyrinth type seals do not operate properly under different air stream pressures therefore shall not be acceptable in any circumstances.
5. Drive system shall be operated by a fractional horsepower motor (maximum 1 HP), reducing gear-box, pulley and v-belt. Belts shall be made of multi-link high-tech urethane/polyester composite.
6. The wheel bearing shall be permanently sealed and press fitted into the wheel matrix for wheel sizes up to 96", and greasable bearings for wheel larger than 96 inches.
7. Wheel speed shall not rotate faster than 20 RPM. Any rotational speed above 20 RPM will be unacceptable.
8. Media cleaning shall be accomplished with any of the following methods: compressed air, low pressure steam, hot water or light detergent without degrading the latent recovery.
9. Reheat control shall be accomplished by a variable speed drive.

C. DESICCANT WHEEL
1. The DES Wheel shall dehumidify and shall be listed or recognized by UL or equivalent.
2. The matrix shall be constructed of corrugated synthetic fibrous media, with a desiccant intimately bound and uniformly and permanently dispersed throughout the matrix structure of the media. Rotors with desiccants coated, bonded, or synthesized onto the media are not acceptable due to delamination or erosion of the desiccant material. Face flatness of the wheel shall be maximized in order to minimize wear on inner seal surfaces and to minimize cross leakage. Rotor shall be constructed of alternating layers of flat and corrugated media. Wheel layers should be uniform in construction forming uniform aperture sizes for air flow. Wheel construction shall be fluted or formed honeycomb geometry. The minimum acceptable performance shall be as specified in the drawings/submittal.
3. The desiccant material shall be selected for low temperature regeneration isotherm properties to provide excellent dehumidification and regeneration characteristics when cycled between a saturated air stream and an unheated or moderately heated regeneration air stream.
4. The wheel frames shall consist of evenly spaced steel spokes, galvanized steel outer band and rigid center hub.
5. Wheel face-seals shall be full contact silicone bulb style to provide for minimum leakage. Peripheral seals shall be full contact nylon brush style or equivalent. Seals shall be easily adjustable.
6. Cassettes shall be fabricated of heavy-duty reinforced galvanized steel or welded structural box-tubing.
7. Bearings shall be inboard, zero maintenance, permanently sealed roller bearings or alternatively external flange or pillow-block style. Drive systems shall consist of fractional AC drive motors with multilink drive belts.

HEAT RECOVERY HEAT PIPE

A. HEAT PIPE (*Aluminum*)
1. Heat-pipe(s) will be installed where indicated on the schedule.
2. Heat-pipe(s) will be constructed from a 1” seamless aluminum tube (0.166 inch walls).
3. Tube center to center will be maximum 2 1/8 inches and spaced 1 7/8 inch between each row. Fin surface will be integral to the tube wall and will be minimum 0.017 inch thick.
4. Fin density will be 14 fins per inch. Fin height, from root to the tip of the fin will be 0.437 inch.
5. A circumferential capillary wick will be integral to the inside wall of the tube.
6. Working fluid will be R-134A refrigerant, with tubes individually processed, charged and factory tested.
7. The supply and exhaust air streams shall be isolated from each other by a single separating partition, a double separating partition, or a foam filled double separating partition. Cross contamination between the air streams is not acceptable.
8. The heat-pipe assembly will be tested in accordance to the latest ASHRAE standard 84 and ARI 1060.
9. Tilt control mechanisms will not be acceptable for heat pipe air temperature control.

B. HEAT PIPE (*Copper*)
1. The Heat Pipes shall be inside and integral to the equipment cabinet in a vertical plane or horizontal plane.
2. The tubes shall be copper, of specific design for Heat Pipe application, permanently expanded onto the fin collar to form a firm, rigid, and complete pressure contact at all operating conditions. Aluminum tubes will not be allowed.
3. The fin surface shall be continuous plate type. Aluminum copper fins of specific design to produce maximum heat transfer effectiveness for Heat Pipe applications. Airside pressure loss shall be as given on the schedule or otherwise specified. Fin density and the number of rows of tubes shall be as specified.
4. The Heat Pipe modules shall have an optional corrosion resistant coating. Heat transfer fluid shall be selected on the basis of operating temperature and compatibility with tube material and shall be classified as Safety Group A1 in BSR/ASHRAE Std 15-1989 R.
5. Heat Pipe capacities, entering and leaving dry and wet bulb temperatures and face velocity shall be as specified.
6. The frames and mounting structure shall be minimum 20 gauge galvanized steel.
7. The supply and exhaust air streams shall be isolated from each other by a single separating partition, a double separating partition, or a foam filled double separating partition. Cross contamination between the air streams is not acceptable.
8. Heat Pipe interconnecting piping and circuitry shall be as specified by the supplier. Each circuit shall be individually processed, charged, and hermetically sealed.

C. CROSS CONTAMINATION PERFORMANCE GUARANTEE
1. The heat pipe core and entire unit assembly shall not allow for cross contamination of airstreams. A bonded silicone core shall be provided at the heat pipe. The unit assembly shall be fully sealed with 0% cross contamination capability at 6"wg. The unit shall be performance tested at the factory under these conditions and a report shall be provided indicating this condition has been met. A copy of this report will be provided to the design engineer before the unit ships. In addition, the factory shall provide a written guarantee of 0% cross contamination and it shall be signed by the officers of the company.

HEAT RECOVERY FIXED PLATE

A. FIXED PLATE HEAT EXCHANGERS
1. Fixed plates heat exchangers shall factory installed where indicated on drawings.
2. The heat exchanger shall be a cross flow plate air-to-air type. The alternate layers of plate create two ducts, one for supply air and one for exhaust air.

3. The plates shall be in pure aluminum for its characteristics of corrosion resistance, ease of manufacture, flame proof, durability and excellent heat transfer properties (option: For aggressive and corrosive applications, the plates shall be coated aluminum or various grades of stainless steel. For special applications with high temperature, plates shall be stainless steel). Minimum plate thickness shall be .008", with positive and negative stamping for spacing and turbulence.
4. The plates shall be sealed at air entry and exit to avoid air leakage and separate exhaust and supply air by proper seals
5. The plates shall be housed inside a casing composed of corner profiles and side walls. The corners of the exchanger package shall be cast and sealed into especially rigid aluminum extrusions in the casing with permanent elastic non-acetic silicone. The side walls shall be manufactured from galvanized steel sheets and bolted to the aluminum extrusions.
6. Plates shall be able to withstand up to 10" pressure differential and 400°F operating temperature when required.
7. The fixed plate heat exchanger assembly shall be tested in accordance to ARI1060 and to ASHRAE 84-91.
8. Access for all four sides of the heat exchanger shall be provided for cleaning and inspection.
9. Temperature and pressure drop performance shall be equal or less than what is scheduled.
10. Stainless Steel drain pan shall be provided underneath the entire Fixed Plate with 1" PVC drains on each 4 sides of the heat exchanger. Drain connections protrude through the side of the unit. Note: Drain lines must be properly trapped and freeze protected in field.
11. Frost control shall be accomplished by face & bypass damper where temperatures fall below freezing. Any other form of defrost shall not be acceptable.

B. ENTHALPY PLATE HEAT EXCHANGERS are no longer supported or allowed by UNLV.

FANS

A. PLENUM FANS
1. Fans shall be direct drive radial centrifugal fans with free running impeller. No fan belts will be acceptable for this application. Fans shall be compact, optimized and construction made of galvanized sheet steel with backward curved 7-blade high efficiency impeller, protected by an epoxy powder coating.
2. To reduce vibration, the impeller shall be balanced with hub to an admissible vibration severity of less than 2.8 mm/s in conformity with DIN ISO 14694 and proof shall be supplied for each individual impeller. Tests shall be made according to DIN ISO 1940 Part 1, quality of balancing G2.5/6.3.
3. The single inlet shall be mounted onto constant speed direct drive motor, equipped with an air flow optimized inlet cone from galvanized sheet steel.
4. Fans shall be completely certified as per ISO 5801 and in accordance to AMCA standards.
5. Fan/ fan bank will require to be operated by a Variable speed drive or one VFD per fan shall be provided with backdraft isolation damper at the event of a fan failure.
6. Optional: Plenum fan shall come equipped with guard grilles for the air intake side.

B. FAN ISOLATIONS
1. The fan housing and motor assembly shall be isolated from the unit cabinetry with a minimum 95% efficient spring isolators or high efficiency rubber isolators or seismic isolators.
2. In addition, fans shall have flexible canvas to reduce vibration transmission.

C. SOUND ATTENUATION IN FAN COMPARTEMNT (OPTIONAL)
1. The fan section shall be constructed with a perforated interior liner, same construction as the housing interior lining and shall be insulated with anti-microbial coating fiber glass. The perforated lining shall be installed on fixed panels only, with exception on the interior ceiling

FAN MOTORS

A. The fan motors shall meet NEMA standard dimensions and comply with the Energy policy Act of 1997.

B. Motors shall have premium efficiencies with low noise and vibration output. Motors shall be certified and built in accordance to ISO 9001 quality control system.

C. Motors shall have ODP enclosure with Premium efficiency performance.

D. Units shall be designed for constant application r. Please refer to the unit schedule for the application type.

E. Option: A shaft grounding brush kit will be provided to prevent electrical damage to motor bearings by safely channeling harmful shaft currents to ground.

VARIABLE FREQUENCY DRIVE

A. VFDs will be installed with bypass for single VFD applications. For AHUs with fan arrays with each fan connected to an individual VFD, a VFD bypass is not required.

B. The VFD shall have PID function for constant flow applications.

C. The VFDs will be installed with integral brake transistor, overload protection, and adjustable pulse-width modulation (PWM).

D. The VFD shall use Insulated Gate Bipolar Transistor (IGBT) technology to convert three phase input power to coded PWM output and have 4-20mA analog output terminals that are fully programmable for variable flow applications.

E. The VFD shall be equipped with a keypad with status indicators, easy access functions, and monitoring functions during motor operation.

F. In the event of a momentary power failure or fault the VFD shall read the inverter speed and direction of a coasting motor and shall automatically restart the motor smoothly.

FILTERS

A. PRE-FILTERS *(2" MERV 10)*)
   1. Filters shall be factory installed upstream of the heat exchanger and coils, in both airstreams.
   2. MERV 10 model High Capacity Serie 400 filters, UL 900 classified are rated as per ASHRAE test 52.2.2012 at 88% efficiency initial (based on Minimum Average Efficiency) at 3-10 microns.
   3. Filters shall be placed in a completely sealed, galvanized holding frame with quick release latches for easy replacement.

B. FINAL FILTERS *(RIGID CELL 12" MERV 11 (60-65%))*
   1. Filters shall be factory installed where shown on the drawings.
   2. Each filter shall consist of 100% high lofted ultrafine synthetic media, in a galvanized steel frame with header, diagonal support bracing, contour stabilizers and metal media support grid. Media is adhesively bonded to all four sides of the frame.
   3. MERV 11 model Rigid Cell filters, UL 900 Class 1 or 2 are rated as per ASHRAE test 52.2.2012 at 97.4% efficiency initial (based on Minimum Average Efficiency) at 3-10 microns.
   4. Filters shall be placed in a completely sealed, galvanized holding frame with quick release latches for easy replacement.

C. HEPA FILTERS *(HEPA 12 (99.99%))*
   1. Filters shall be factory installed where shown on the drawings.
   2. The air filters shall be Filtration Lab's for supply airstream only. High-efficiency particulate air (HEPA) filters are designed to screen particles larger than 0.3 µm.
   3. Holding frames shall be constructed of galvanized steel. The frame shall be supplied with a closed cell gasket to the rear seating flanges of the frame. Each frame shall be supplied with positive sealing filter locks for front access loading.

HUMIDIFIER

A. HUMIDIFIER STEAM GENERATOR
   1. Gas fired steam generator

B. HUMIDIFIER STEAM DISPERSION PANEL
   1. Short Absorption Manifold designed for atmospheric steam humidifiers or pressurized steam from a boiler, to directly inject the steam into ducted air for humidification.
   2. Absorption distance characteristic shall prevent water accumulation on any induct surfaces downstream of the steam dispersion panel.
   3. Steam dispersion panel consisting of a (one) horizontal stainless steel header supplying steam to a bank of closely spaced 3" (7.6 cm) OR 6" (15.2 cm) OR 9" (22.9 cm) OR 12" (30.5 cm) vertical tubes (3" (7.6 cm) OR 6" (15.2 cm) for mini SAM-e), as necessary to meet absorption distance requirements, and to reduce condensation losses.
   4. Single horizontal stainless steel header to provide steam to vertical distributor tubes and to reduce condensation losses. Dual header systems creating unnecessary condensation, or systems needing to be installed on a partition or requiring blank off plates are not acceptable.
   5. Header design is primarily round tube to minimize pressure drop. Square headers are not acceptable.
   6. Slim profile rectangular profile header design minimizes pressure drop.
   7. Steam inlet and condensate return located on the same side and at the bottom of the header to allow single point entry and floor mounting.
   8. Headers are 304 stainless steel construction.
   9. Vertical stainless steel distribution tubes to promote condensate evacuation. Horizontal distributor tubes are not accepted.
   10. Distribution tubes shall include threaded standoffs for trouble free attachment to factory- supplied support bracket.
   11. All tubes are 304 stainless steel construction.
   12. Stainless steel nozzle inserts ensure condensate free steam is discharged from the center of the distribution tubes. Systems without nozzle inserts, or other than stainless steel, are not acceptable.
   13. Stainless steel nozzle inserts shall have metered orifices, sized to provide even distribution of the discharged steam, spaced for optimum steam absorption.

DAMPERS

A. NON-INSULATED
   1. Dampers shall be installed where shown on the drawings.
   2. Dampers shall be low leak type with rubber edges, opposed blades, and constructed from extruded aluminum. Galvanized dampers will not be acceptable.
   3. The exhaust air outlet shall have a standard aluminum gravity type damper, unless otherwise noted.
   4. Dampers shall be installed in the compartments (as shown on the drawings) with linkage rod for actuators

DIRECT EXPANSION AHU - CONDENSING UNIT

A. AIR COOLED CONDENSING UNIT WITH VARIABLE SPEED COMPRESSORS

1. Provide an integral air cooled condensing section with variable speed compressors. The condensing section shall be factory piped, wired, and charged with R-410A refrigerant. The section shall be from the same manufacturer as the air handling unit. Factory mounting and piping an air cooled condensing unit, provided by a third party is not acceptable. Furthermore, the exterior cabinet of the air cooled section shall be of the same construction and paint color as the air handling unit.
2. Compressors shall be variable speed scroll type that can modulate from 25% to 100% capacity per compressor. Variable capacity compressors which do not modulate the speed of the scrolls are not considered equal to a variable speed scroll since they consume more energy at the same capacity output. Mechanically stepped scrolls which are unloaded via a digital signal to a solenoid valve, in a timed sequence, will not be acceptable. The variable speed scrolls shall be operated via a factory supplied variable speed controller per compressor, and all tandem compressors will modulate in unison. Using a single variable speed controller on the lead circuit alone is not proven effective nor efficient during part load conditions, therefore will not be acceptable. Each compressor and controller assembly shall be equipped with the following features: permanent magnet motor, electronic expansion valve, a crankcase heater function, anti-short cycling, built-in phase loss detector, EMC filter, oil return management system, and reverse rotation protection. All refrigeration parts, including the compressor and the speed controller will be located in a closed and vented service compartment, separate from the condenser coil airflow. Compressors located in compartments open to the outside are not acceptable. Compressors shall be mounted on rubber isolators to limit vibration transmission and shall include flexible hoses on both the suction and discharge refrigeration lines. Flexible hoses shall be pressure tested up to 620 psig.
3. All air cooled condensing units above 18 tons will have a minimum of two compressors.
4. Condenser fans shall have air foil type blades with external mounted asynchronous motors that are class F insulated, IP54 and 100% variable speed. Each condenser fan bank shall be provided with a variable voltage controller which modulates via refrigerant head pressure control for superior part load performance. All the condenser fans in a fan bank shall modulate in unison for each respective circuit. Staging condenser fans are not an acceptable mode of control for head pressure control. Protective guards shall be included on all condenser fans, and condenser coils. The coil protective guards shall be ideal to keep coil at maximum operating performance, protect the condenser from hail damage and allow for easy cleaning with quick release latches. The condenser coils shall be micro-channel design for maximum efficiency performance, consist of a single pass arrangement with integral receiver, and be pressure tested to a minimum of 650 psig. Coil construction shall consist of aluminum alloys for the fins, tubes and manifolds. Copper tube, aluminum fin condenser coils are not acceptable as they require more frequent cleanings and care to maintain unit efficiency.
5. The following components shall be included in each refrigeration circuit: Liquid line filter dryer, hi and low pressure switch, hi and low pressure transducers, suction and liquid lines shutoff valves and suction line accumulators. In addition, refrigeration piping must use schrader type connections for all components, including but not limited to valves and transducers. Under no circumstances shall the units leave the factory without a complete run test and a copy of the QC report shall be provided upon request.
6. Minimum (5) five year compressor warranties shall be provided.

B. WATER SOURCE HEAT PUMP UNIT WITH VARIABLE SPEED COMPRESSORS

1. Provide integral water source heat pump (WSHP) section(s) where indicated on the schedule. The section shall be contained in the same housing as the rest of the unit (see housing details). The WSHP shall be manufacturer by the same manufacturer as the air handling unit. Factory mounting a third parties WSHP is not acceptable. The WSHP shall be mounted within a framing system that supports all components, independent of the air handling unit casing. An access

panel shall be provided to the compressors and adequate clearance shall be provided for the removal and replacement of any refrigeration component without having to remove the entire WSHP module. It is not acceptable to have to remove the unit casing or the entire WSHP module to replace any refrigeration component. The WSHP section shall include a floor drain as a protective element to remove any water build up in the section. Exterior units shall have a pipe chase located in the same compartment as the WSHP. Exterior units shall also include an auxiliary heater to provide freeze protection to the water circuit. Exterior units without auxiliary heaters are not considered adequately protected for winter conditions and will be rejected. The auxiliary heater shall be on the same electrical circuit as the unit.

2. Compressors shall be variable speed scroll type that can modulate from 25% to 100% capacity per compressor. Variable capacity compressors which do not modulate the speed of the scrolls are not considered equal to a variable speed scroll since they consume more energy at the same capacity output. Mechanically stepped scrolls which are unloaded via a digital signal to a solenoid valve, in a timed sequence, will not be acceptable for this application. The variable speed scrolls shall be operated via a factory supplied variable speed controller per compressor, and all tandem compressors will modulate in unison. Using a single variable speed controller on the lead circuit alone is not efficient during part load conditions, therefore will not be acceptable for this application. Each compressor and controller assembly shall be equipped with the following features: electronic expansion valve, reversing valve (WSHP only), a crankcase heater function, anti-short cycling, built-in phase loss detector, EMC filter, oil return management system, and reverse rotation protection. Compressors shall be mounted on rubber isolators to limit vibration transmission and shall include a vibration eliminator conduit on both the suction and discharge refrigeration lines. Vibration eliminator conduit shall be pressure tested up to 620 psig.
3. A coaxial coil shall be provided for all water to refrigerant heat transfers. Plate type exchangers are not permitted as they require routine maintenance which is not acceptable for this application. The coaxial coil shall be copper/steel in construction and completely insulated. The refrigeration suction line shall also be completely insulated. All water connections (in and out) will be connected by the mechanical contractor. The refrigeration system shall be equipped with a factory programmed and installed controller that will modulate the system based on a 0-10v signal. Head pressure and suction pressure control logic shall be provided on all WSHP models. Head pressure and suction pressure control is required in both cooling and heating operations to account for changes in entering water temperature. Systems that do not have head pressure control logic built into the water source heat pump or water cooled condenser shall not be considered for this application as head pressure control is considered a required safety feature. A 2-way modulating control valve shall be provided and installed by manufacturer.
4. Hose kits shall be provided by the mechanical contractor. Hose kits to include Belimo valve and actuator, manual balancing valve, strainer, isolation valve, and all necessary piping and components to provide a one inlet and outlet water connection per coaxial coil.
5. High pressure relief plug with extension to unit exterior will be provided on units where required by code.
6. The entire section shall be factory piped, wired and charged with R-410A. Each refrigeration system shall be factory tested.
7. Minimum (5) five-year compressor warranties shall be provided.

COILS

A. DIRECT EXPANSION AHU – EVAPORATOR COILS

1. Coils shall be designed with respective circuits to match the design requirements. All coils shall have a distributor per circuit connection. Coils shall be circuited for counter-flow heat transfer to provide maximum mean effective temperature difference for maximum heat transfer rates.
2. Casing shall be constructed of continuous galvanized steel.
3. The complete coil shall be tested with 315 pounds air pressure under warm water and be suitable for operation at 250 psig working pressures. Maximum finned coil height shall be 60” and shall not exceed 500 FPM face velocity.

4. Drain pan shall be provided on cooling coils. Cooling coils shall sit on stainless steel tubular support rails, which shall stand a minimum of (2) two inches above the highest point of the floor drain pan. Stacked coils shall be provided for larger airflows and intermediate drain pans shall be provided for each coil bank. Drain pans shall be stainless steel with 1.25” stainless steel drain connections on one side only. Pan shall be sloped in two planes.
5. Optional; Hot Gas reheat coil shall be installed down stream of direct expansion coil. The control for the hot gas reheat shall be full modulation type for superior humidity control. Coil shall be same construction as direct expansion coil.

B. WATER COILS
1. Primary surface shall be round seamless (5/8" O.D.)copper tube staggered in the direction of airflow. Secondary surface shall consist of rippled aluminum plate fins for higher capacity and structural strength. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates.
2. Coils shall be circuited for counter-flow heat transfer to provide maximum mean effective temperature difference for maximum heat transfer rates.
3. Headers shall have intruded tube holes to provide a large brazing surface for maximum strength and inherent flexibility
4. Casing shall be constructed of continuous galvanized steel.
5. The complete coil shall be tested with 315 pounds air pressure under warm water and be suitable for operation at 250 psig working pressures. Maximum finned coil height shall be 60” and shall not exceed 500 FPM face velocity.
6. Drain pan shall be provided on cooling coils. Cooling coils shall sit on stainless steel tubular support rails, which shall stand a minimum of (2) two inches above the highest point of the floor drain pan. Stacked coils shall be provided for larger airflows and intermediate drain pans shall be provided for each coil bank. Drain pans shall be stainless steel with 1.25” stainless steel drain connections on one side only. Pan shall be sloped in two planes.
7. All coils shall be rated and certified in accordance with AHRI standard 410.

C. MOISTURE ELIMINATORS
1. Furnish all 304 stainless steel moisture eliminator with rigid stainless steel frame, (1) one inch thick when indicated in plan schedule or AHU detail drawings.
2. The air pressure drop shall not exceed 0.1” at 500 FPM velocity and shall remove 99% of all water droplets at 500 FPM.

D. ULTRAVIOLET LIGHT SYSTEM
1. Provide Factory Installed UV Lamps mounted to Anodized Aluminum Parabolic Reflectors upstream/downstream of the cooling coil section where indicated on the drawing.
2. Lamps will be warranted for a period of 12,000 hours and high frequency electronic ballasts will be warranted for (5) five years. Options shall include visual panel indicators lens provided in the section.

E. EVAPORATIVE COOLING is not preferred /nor prohibited method of cooling for UNLV
1. Provide evaporative cooling modules where shown and/or scheduled on the drawings. The evaporative cooling module shall be a self-contained, single housing unit consisting of a housing with sump, sides and top, rigid cooling media with support channel, water distribution system, make-up water, drain and overflow fittings.
2. The evaporative cooling module shall be constructed from Stainless Steel, grade 304. The outer housing shall consist of a sump, sides and top. An externally mounted access panel shall be provided for access to and adjustment of the float valve assembly and balancing valve to control water flow to header pipe. The housing shall also provide a method of cooling media access and removal. Media removal method is through removable rails on the intake and/or discharge side of media. All metal in the wet section shall be Stainless Steel, grade 304.

3. A media support channel with punched holes on a staggered pattern shall be included. This channel shall extend across the full width of the media. The channel shall provide a minimum of 50% open area for water to flow freely from the media into the sump. An air bypass inhibitor plate shall be provided from the bottom of the media, extending into the water to preclude any untreated airflow under the media.
4. Sump construction shall include TIG (fusion) welded corners and joints. The sump shall be leak proof without the use of fillers, sealants or coatings.
5. Internal plumbing shall be PVC sized to meet flow rate demand.
6. A PVC union shall be provided in the riser pipe below the header pipe to facilitate removal of the header pipe. Stainless steel couplers with female pipe thread shall be welded into the sump and side to provide for make-up water, overflow and drain. Sizes shall be ½" MPT for make-up water, 1" MPT for drain and 1" MPT for overflow, unless otherwise specified
7. A balancing valve shall be provided in the riser pipe between the source and header to regulate water flow over the media. Header pipe shall contain self-cleaning orifice holes sized to assure proper water flow over the media. Water from the header pipe shall be discharged upwards against a stainless steel deflector to redirect the water from the header pipe back onto the media, evenly across its full width.
8. Water distribution system shall be pump re-circulating system with mechanical float valve assembly to maintain water level in the sump. Pump horsepower and voltage requirements, as specified in the schedule. Pump shall be sized to deliver water flow rate at the head and pressure required. Flow rate shall be determined at (3) three times the evaporation rate plus the bleed-ff rate. 1/3 & ½ HP pumps will be bronze pump head with close coupled ODP motor and brass foot valve with heavy duty brass inlet screen.
9. Provide Glas-Dek media, fire rated UL 900, Class II, maximum face velocity without moisture eliminators shall be 600 FPM. Cooling media shall be rigid media, cross fluted pad. The transverse flutes shall be 45° and 15° with water flow downwards in the direction of the 45° flute and air flow downward in the direction of the 15° flute. Media shall have no more than 0.315" w.g. air pressure drop at 500 FPM face velocity and shall develop a saturation efficiency of not less than 90% for 12" and 96% for 18" thick media.
10. Provide factory installed float switch to lock-out spray pump until sump fill level is sufficient to submerge the pump inlet. At the end of the spray header, provide a tee with cap to a ball valve and piping that discharges into the sump to allow for flushing of the header for maintenance. Refer to "Instrumentation and Controls" for drain and fill valve requirements. Provide a secondary drain downstream of the evaporative cooler module and of the sump to catch any moisture carryover. Supplied evaporative coolers shall have (2) two pumps per module, splitting the media in a 1/3 – 2/3 arrangement, wired to a non-fused disconnect. Downstream and underneath the evaporative cooler, provide flat stainless steel drain pan with a 1" PVC drain connection, exposed galvanized sheet metal is not acceptable.
11. Options available: Copper piping, UV lighting, dual redundant pump.

BURNERS

A. INDIRECT GAS FIRED FURNACE
   1. Furnish and install where shown on plans Gas-fired Duct Furnace Heat Module(s).
   2. The module shall be a Recognized Component by Intertek Testing Services (ITS / ETL). All modules will have a minimum thermal efficiency of 80%.
   3. The module shall employ a tubular heat exchanger and a draft inducer assembly to provide for positive venting of flue gases. Burner assemblies shall employ in-shot type burners constructed of aluminized steel body and sintered metal flame holder with integral carryover plenum.
   4. The ignition system will include a 6000 V Igniter and flame rod detection. Ceramic hot surface ignition systems are unacceptable.
   5. Gas-fired duct furnace(s) provided shall employ a tubular heat exchanger constructed of 18-gauge minimum, type409 stainless steel, and 1 ¾" to 2 ¼" diameter having a minimum wall thickness of 0.047". Tubes and shall be produced to ASTM A249 standards for heat exchanger application. Tubes shall employ integral formed-dimple restrictors to eliminate noise associated

with expansion and contraction of internal baffles during heating cycles, and to provide for unobstructed drainage of condensate that occurs in the tubes during cooling operation. Drainage shall be configured so that burners and burner surfaces are not exposed to condensate during cooling system operation.

6. Full Modulation control shall be provided. On a call for heat and subsequent safe burner light OFF, the burner modulation shall be minimum 5:1, 10:1, 20:1 or 30:1 as noted on the schedule. Stepped modulation is not acceptable. Controls shall include an ignition control with alarm capable contact and one hour auto reset on lockout, roll out switch, high limit switch and a proving switch of loss of the induced draft fan. Additionally, on modulating and 2-stage systems all timing and switching functions shall be controlled through an electronic timer relay control. Staging controller available for 0 to 10VDC or 4 to 20mA input from building management control.
7. Burners will use Natural Gas (with gas pressure min 7"-max 14"wc) unless otherwise specified. Gas train compartment shall be provided with 1” PVC drain.

ROOF CURB

A. A non-insulated, pre-fabricated roof curb shall be provided and shipped knocked down. The roof curb will be made of 16-gauge galvanized steel with 4” flanges, minimum 17” high with a factory installed 2” x 3” wood nailer strip.

POWER AND SAFETY CONTROL

A. The power and control center shall be integral to the unit housing and rated equivalent to NEMA 3R.

B. Under no circumstances shall any wiring or parts be field installed. If units show up at the job site without wiring by the manufacturer, the contractor will have to send back units to the manufacturer at the contractors’ expense to get them factory wired and re-tested.

C. Panels that are externally mounted to the unit shall not be accepted, regardless of the NEMA rating they may have. A separate access door shall be provided with an approved locking device.

D. All electrical components contained in the panel shall be UL/CSA certified and labeled. The unit shall be complete with VFDs, fuses, relays, phase protection for compressorized units, terminals for main ON/OFF and step-down transformer. All components shall be factory wired for single point power connection by the manufacturer of the unit. A non-fused safety disconnect switch shall be factory installed for ON/OFF servicing.

E. An electrical pipe chase for power and control feeding shall be provided next to the control panel.

F. Any power or control wiring that is field installed shall not be accepted under any circumstances. The Short Circuit Current Rating (SCCR) is 5 kA rms symmetrical, 600V Maximum or as noted on schedule.

G. GFI, lights, and switches shall be factory installed and wired to a common junction box. A separate power connection 120V/1 will be required (powered by others).

INSTALLATION GUIDELINES

A. General
   1. Automatic temperature controls and the sequence of operation must be as shown on the drawings or detailed in ATC specifications.
   2. Install air handling units so that the coil or fan shaft can be replaced.
      a. Provide access to all components for servicing and maintenance.
   3. Outdoor Air Intakes
      a. Do not place fresh air louvers near a loading dock or near diesel generator exhaust.

   b. Do not locate intakes near collected organic debris, such as wet leaves, animal nests, trash, wet soil, and grass clippings, or in low areas where dust and moisture collect.
4. Verify that intakes do not provide ledges that will collect bird droppings.
5. Locate intakes per code to ensure adequate separation and dilution given the contaminant source concentration and nature, the direction of prevailing winds, and building geometry.
6. Install intakes at least six feet above grade and three feet above the roof.

TESTING

A. System verification testing is part of the commissioning process. Verification testing shall be performed by the Contractor and witnessed and documented by the Commissioning Authority. Refer to section 01810, Commissioning, for system verification tests and commissioning requirements.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Malfunctioning units are to be repaired or replaced, replace with new units, and retest.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

TRAINING

A. Training of the Owner’s operation and maintenance personnel is required in cooperation with the Commissioning Authority. Provide competent, factory-authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Commissioning Authority after submission and approval of formal training plans.
B. Contact Annexair to request pricing to include factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and define routine maintenance schedules.
   1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
   2. Review data in maintenance manuals.
   3. Schedule training with Owner, through Architect, with at least seven days advance notice.

SECTION 15733

ROOFTOP REPLACEMENT AIR-UNITS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for rooftop package and custom air conditioners.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Sound levels at building entrances and exits must meet UNLV acoustical requirements.

Glycol/hot water is the preferred method for preheat coils. Provide recirculation pumps for each preheat system.

Coordinate seismic installations with the structural designer, and verify that code requirements are met.

For units equipped with cooling coils, size air handling cabinets for a maximum coil face velocity of 475 fpm.

When blow-through units are specified, ensure that there is an appropriate means of distributing air across the entire coil face. The use of plenum fans in blow-through applications is preferred because they promote even air distribution and velocity across the coil face.

Plenum fans arc preferred in draw-through applications where discharge duct configurations (associated with centrifugal fans) cause system effect losses and noise.

To minimize noise from a rooftop units:

Follow ASHRAE and SMACNA recommendations for duct transition geometry near the fan.

Use round ductwork over sensitive spaces.

Locate units as close to the main supporting columns as possible.

Cut out only enough decking for ducts. Do not cut out decking under the entire roof curb.

Do not oversize units.

When an elbow must be placed within 1.5 duct diameters of a high-velocity fan discharge, it should be placed along a radius elbow that does not have turning vanes.

After test and balance has determined the proper fan speed using an adjustable sheave, replace the adjustable sheave with a fixed one of the proper pitch.

Ensure that there is adequate structural support for the equipment and that wall and floor assemblies have sufficient mass to attenuate low-frequency noise around the equipment.

Extra Materials
Provide two sets of filters and fan belts.

SUBMITTALS

Designer Submittals
Custom unit designs must be reviewed and approved by UNLV Planning and Construction/Engineering.

Construction Documents
The contractor must certify that rooftop air conditioners, accessories, and components will withstand seismic forces.

PRODUCT STANDARDS

Products must conform to the following standards:

Units must be ARI-certified and listed.

Electrical components, devices, and accessories must be listed, labeled, and marked for intended use—as defined in NFPA 70, Article 100—by a testing agency acceptable to authorities having jurisdiction.

The refrigeration system must be fabricated and labeled in compliance with ASHRAE 15: Safety Code for Mechanical Refrigeration.

The energy-efficiency ratio must be equal to or greater than prescribed by ASHRAE 90.1: Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings.

The coefficient of performance must be equal to or greater than prescribed by ASHRAE 90.1: Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings.

Manufacturers
Subject to compliance with the design requirements, provide products by one of the following manufacturers:
Custom Rooftop Air Conditioning Units
- Air Enterprise
- Industrial Sheet Metal
- Buffalo Air Handling
- Webco
- Governair

Package Rooftop Air Conditioning Units
- Carrier Corporation
- Lennox Industries
- McQuay
- Trane Company
- York International
- Engineered Air
- Governair

MATERIALS

Exterior doors on all custom units must be stainless steel.

Do not use exposed fiberglass ductwork in air handlers.

Accessories or Special Features

Whenever possible, provide motor lift rails on units with motors larger than 10 hp.

Spaces for controls must be kept dry and the temperature maintained between 60 and 95°F.

Equip small package units with self-diagnostics.

Factory-installed controls must be compatible with the UNLV building automation system.

Direct-drive actuators and damper blades must be driven by gears instead of linkages. These designs improve the mechanical reliability of the economizer/outdoor air section by reducing the number of moving parts.

Unit to have disposable pre-filters, 4 inch thick, meeting MERV 6. Final filters to be MERV 13 or better. Strion electro-static filters shall be evaluated for large units. Provide sound attenuators in unit.

Special Requirements

Install gutters above exterior doors that drain away from the doors.

Provide all units with a laptop plug-in port for unit analysis.

Design variable-frequency drive (VFD) enclosures with an appropriate ventilation fan.

Maintain the minimum clearance between VFD cabinets recommended by the manufacturer.

Outside air dampers must be airfoil-type with edge seals to provide a tight-closing, low-leakage damper.

All water coils must have copper tubes and return bends with a minimum thickness of .035." Headers must be non-ferrous. Fin spacing should not exceed 12 fpi.

Use only manual reset freezestats; automatic freezestats are not acceptable.

All closed-loop heating/cooling systems to rooftop air handlers" must have adequate air venting. Vents must be automatic, with a ball valve between the vent and the piping, and equipped to handle system pressure.

Unit roofs must be sloped.

Drain pans must be at least 18-gauge stainless steel, insulated, and pitched to drain. Drain pans must extend in the direction of airflow far enough to catch condensate at the maximum recommended coil air velocity.

Units must have single-point power connections.

Each section of the unit that provides service access must be equipped with watertight, wire-guarded marine lights. At least one ground-fault-interruption receptacle must be located at each access side of the unit.

Unit curbs must be 12" high and factory-built to ensure the correct fit.

At a minimum, provide access doors at fan and cooling coils.

Fans, motors, and drives must be internally spring-isolated on a structural steel base, complete with flex connections and lateral restraints.

The roof and floor must be of double-wall construction. Panels must be unitized to prevent disturbing the insulation if the panels are removed.

Perforated inner walls are acceptable for use in all sections, except in the outside air intake, cooling coil, and humidifier sections.

The doors on positively-pressurized sections must swing inward. The doors on negatively-pressurized sections must swing outward.

Coils sections must be separated by a minimum space of 18". Each coil section must be equipped with a full-size access door.

Controls must be located in a heated space. Provide sufficient space to work with the door to the air handling unit closed.

INSTALLATION GUIDELINES

Do not block maintenance or coil-pull access doors with equipment or piping installations.

Exposed heating or cooling piping and valves on the roof is prohibited. Locate all valves and piping within the building or within the air handling unit.

Verify that unit installations are level.

All roof penetrations must be sealed and waterproofed.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

SECTION 15734

COMPUTER-ROOM AIR-CONDITIONERS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for computer room vertical and horizontal air conditioning systems for computer room specific applications.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Provide for 100% redundancy of internal cooling unit components or system provisions so that if any part of the process cooling system fails, the remaining equipment will continue to properly cool the room.

Provide local alarm and an alarm to the campus EMS for:
- Temporary loss of power
- On failure or need for servicing of the equipment
- Loss of airflow
- Dirty filters
- Any overload condition
- Excessive room temperature

Determine whether the use of outdoor air is cost-effective. The cost of humidification might outweigh savings in compressor energy.

Specify cooling systems that discharge air at a relative humidity that meets computer manufacturer relative humidity requirements.

Coordinate with room designer and to provide methodology to make room vapor-tight when humidification systems are required.

SUBMITTALS

Submit the following design and certification documentation.
- Designer Submittals
- Estimated cooling load
- Life cycle cost of humidification
- Report on the methods used to make the room vapor-tight
- Life-cycle cost of the cooling system, including cost to make room vapor-tight

Product Certificates Signed by the Manufacturer
Specify that computer room air conditioning units be inspected by the manufacturer's authorized representative who shall submit a written report to the engineer with copy to UNLV stating that the computer room units have been properly installed, are operating correctly, and the installation is acceptable to the manufacturer in every respect.

APPROVED MANUFACTURERS

Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include the following list of manufacturers. All other manufacturers seeking approval to bid must get written approval from the engineer, in consultation with the UNLV Facilities & Maintenance department, prior to submitting any price for the project.

- Liebert
- Compu-Air
- Stulz

INSTALLATION GUIDELINES

When ventilation air is brought into the computer room, provide a positive ventilation system to take in outside air and discharge into the intake of the process cooling system.

Ensure that all cracks are sealed, including cracks in any sub-floor, to preclude dust from entering the data processing equipment Ensure that the room is a vapor-tight envelope.

Verify that there is sufficient space in the use of an underfloor distribution system to allow for the velocity pressure of the air handler discharged air to develop into static pressure. Not doing so can lead to hot spots where the pressure is insufficient to enter the data processing equipment.

For water cooled fan coils and systems provide PEX type piping only with a minimum of fused joints to reduce risk of water leaks within the computer room. No mechanical joint allowed, with exception to the main water line trunk and endpoint connection to the condenser or water coil. Avoid running condenser water feed lines in underfloor cavity.

Provide accessible shutoff valves.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in (the commissioning specification section.

Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

SECTION 15738

SPLIT-SYSTEM AIR-CONDITIONING UNITS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for split-system air conditioners.

System Design and Performance Requirements
Provide complete a DX system for central station air conditioning. The system must consist of matching air-cooled condensing units, compressors, piping, controls, wiring, and other accessories, as well as the appurtenances necessary to provide a fully-automatic system.

MATERIALS

Condenser coils must be aluminum plate fins, mechanically bonded to seamless copper tubes, circuited for subcooling.

Provide openings for power and refrigerant connections.

Provide a service access panel.

Provide copper tubes, circuited for sub-cooling. Provide propeller fans arranged for vertical discharge. Condenser fan motors must have inherent protection, and must be permanently-lubricated and resiliently-mounted. Fans must have safety guards. Provide controls for cycling fans.

Compressors must be serviceable, hermetic compressors, with external spring isolators and an automatically reversible oil pump.

Compressors must unload in steps, in response to suction pressure, for partial load operation. Separate compressors from condenser fans and coils.

Multiple compressor units must have stop-start fans and coils. Compressor motors must have a part-winding start.

Provide refrigerant piping between air-cooled condensing units and air conditioning units. Refrigerant piping must be equipped with the necessary auxiliary equipment, such as strainers, sight glasses, oil traps, scale traps, and other devices, to make the system complete and operable under fully-automatic control.

Refrigeration piping must be ACR copper tubing made up with wrought copper fittings, using silver solder and installed with a nitrogen charge while soldering. Use the piping size recommended by the manufacturer of the air conditioning unit and matching air-cooled unit. Casings must be galvanized steel finished with baked enamel.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section.

Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

SECTION 15761

AIR COILS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for HVAC system components for hydronic, electric, and steam coils.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Initiate a discussion with the UNLV Facilities group about the need for split coils, center supply, and similar types of equipment, to provide good air distribution.

Use non-freeze, steam preheat coils wherever steam is available in sufficient quantities. Use hot water-glycol preheat coils where steam is not available.

Provide electric coils equipped with perforated plates to equalize airflow across the face.

Provide completely drainable chilled water coils. Coils must be ARI certified, and the scheduled performance must be guaranteed by the manufacturer. At design conditions, the coils must provide a minimum water temperature rise of 15°F.

The cooling coil face velocity must not exceed 600 fpm based on the final judgment of the design engineer. Final system must not have moisture carryover, sufficient static pressure nor sound regeneration. Provide an intermediate drain trough for each section of coil banks more than one coil high. Extend the trough a minimum of 6" downstream of the coil face, and pipe it individually piped to the unit pan. Each coil section drain must have a deep seal trap and extend to an open sight drain.

The cooling section of a built-up unit must have a trapped drain at the bottom. Deep seal traps might necessitate raising the entire unit above the floor or disposing of drainage on the floor below.

Preheat coils must be water coils or freeze proof like the Cooney Freeze Block ™ cooling coils. Preheat coils downstream of heat recovery wheels or coils may be standard steam distributing coils.

Provide hot glycol-water systems for preheat coils, unless face and bypass steam coils (integral or conventional) are used. Hot glycol-water is preferred over steam for heating coils and reheat systems. To maintain flow rates at a relatively high level, reset the hot water temperature inversely with outdoor temperature.

Where heat recovery equipment is used in conjunction with a preheat coil, size the preheat coil taking full advantage of the energy recovery investment (oversizing is not necessary).

The preheat and heating coil maximum face velocity must be 800 fpm for standard coils and 600 fpm for integral-face and bypass coils to hold the pressure drop to about 0.25" WC.

Offset the piping to coils, and arrange shut-off valves and flanges or unions to permit the removal of the coil from the side of the unit.

Heating coils immediately upstream of the cooling coils must be designed for face velocities close to that of the cooling coils.

SUBMITTALS

Provide a list of heating and cooling coil selections.

MANUFACTURERS

Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

- RAE
- Armstrong Type C or T coils for below freezing temperatures
- Trane
- Heatcraft
- Cooney Freeze Block
- Wing-bypass steam coils

MATERIALS

General service requested that 24” access space be provided for cleaning on the entrance and exit sides of the coils.

Casing must be hot-dipped galvanized steel.

Headers must have stainless steel barrels with vents; drains; and serpentine, continuous tube design suitable for 200 psig working pressure.

Coils must be housed in a factory-fabricated frame, independent of the unit casing.

Coil frames must be 11-gauge, hot-dipped, galvanized steel.

Coil frames must support coil sections independently to enable the coil to be removed through the unit casing normal to direction of airflow, without disturbing other coil sections.

Coil casings must have a removable panel on each side.

SECTION 15763

FAN-COIL UNITS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for hot water, and chilled water fan coil units.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

New buildings should not allow for fan coil units except as noted herein. Fan coil units should only be used if ductwork cannot be installed in an existing building, or if local loads are beyond the capacity of the building air conditioning system.

Fan Coil Units (serving data closets, server rooms, and IDF rooms)

Dedicated fan-coil unit shall be utilized for all IDF rooms in order to maintain the room temperatures between 72o F and 75o F. UNLV to conform the room temperatures. IDF rooms shall be properly zoned in order to provide the alternate source of cooling during the winter season when the central plant is shut down. Adequate back-up shall be designed (dry cooler or DX system) for winter operation.

Fan coil units should typically be located in an adjacent room and then ducted into the data-electrical room (due to inherent problems with water piping and/or condensate drain piping being routed above sensitive electrical panels and equipment).

Select fan coil unit cooling coils with an entering water temperature if no less than 55 F (to extend potential hours for use of water-side economizer and dry cooler system in the winter season- particularly during unoccupied hours.)

Designate a 36” by 36” service/access area at each fan coil unit (fan coil unit no more than 18” above ceiling).

Require electrical disconnect, control enclosure, coil connections, and filter access to be located on the same side of each fan coil unit (to allow for access from a single service/access location).

Provide a discharge air temperature sensor at each fan coil unit.

SUBMITTALS

Submit heating or cooling load calculations for fan-coils and the reason why they are needed.

MANUFACTURERS

Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to the following:

- Envirotech
- Trane
- First Company
- Carrier

- York
- Titus
- Nailor
- IEC

MATERIALS

Fan coil units must include the following components:

A galvanized steel cabinet with a baked enamel finish liner, covered with UL 25/50 Mylar or foil.

Service panels on the bottom of ceiling-mounted equipment that must be hinged or provided with safely chains to prevent them from falling when opened.

Direct drive fans with ECM or local modulation control for final CFM and static pressure balancing.

All hydronic coils are to leak test the coil at an air pressure of 350 psig.

Heating and cooling control valves are to be Belimo PCIQC or CCV type based on service gpm. Provide shut off valves with PTs ports for flow measurements, stainless steel braided hoses located between the FC and the main branch line connection with manual valves to isolate each fan coil.

INSTALLATION GUIDELINES

Provide 36” min clearance for filter, motor, and valve maintenance access. Valves and controls shall be located on the same side of the FCU.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section.

Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

END OF SECTION

SECTION 15766

CABINET AND UNIT HEATERS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for electric, and heating hot water cabinet and unit heaters.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Cabinet unit heaters should be used in and near outdoor entrances, at the base of stairwells, and in other locations that require heat but do not have the wall space for fin tube radiation.

Unit heaters should be used in non-public spaces that require additional heat and have steam or water available. Non-public spaces include mechanical and storage rooms. Electric unit heaters should be used in electric rooms.

Electric cabinet heaters should be used only if the cost to pipe hot water is prohibitive.

The mechanical system engineer will determine hot water cabinet heater piping installation guidelines.

Manufacturers
Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:
- Carrier
- York
- Trane

MATERIALS

Electric Cabinet Heaters

Cabinet heaters must be factory-assembled for field installation. Cabinets must be 16-gauge steel, with corrosion-resistant finishes.

Heating coils must be single terminal end, long-life electric fin tube coils, with brazed helical- coiled fins.

Provide cabinet heaters with automatic reset thermal overload protectors.

Filters must be disposable.

Hot Water Cabinet Heaters

Cabinet heaters must be factory-assembled for field installation.

Coils must have seamless copper serpentine lubes and aluminum or copper fins bonded to the tubes. Coils must be tested at 200 psig air pressure without leaks.

Provide cabinet heaters with tamper-proof front panel screws and key latches.

Filters must be disposable.

Provide a factory-mounted disconnect switch.

Each unit must be valved separately and have union connections to facilitate easy removal.

Hot Water Unit Heaters

Unit heaters must be factory-assembled for field installation.

Coils must have seamless copper serpentine tubes and aluminum or soldered copper fins bonded to the tubes. Coils must be tested at 200 psig air pressure without leaks.

Hangers and supports must incorporate vibration and noise isolators. The motor and fan must be separated from the healer by resilient vibration isolators. Provide OSHA-approved fan guards on the heaters.

Each unit must be valved separately and have union connections to facilitate easy removal.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

SECTION 15815

METAL DUCTS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for rectangular and round metal ductwork, duct liners, and hangers for supply, return, and exhaust systems.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Keep the ductwork layout simple to reduce ductwork system cost. Use short, direct runs where ever possible, and conserve ceiling space.

All return/exhaust air must be ducted. The use of ceiling plenums for return/exhaust air is prohibited.

Perchloric acid fume exhaust ductwork must be individually ducted without connection to other exhausts.

Fume hoods and contaminated or hazardous areas must be exhausted by a system of ducts entirely separate from all other exhaust systems. The location of area exhausts should be carefully coordinated with reference to remoteness from supply air outlets, doors, and windows. Animal areas and toilet rooms shall have separate exhausts.

Wherever possible, exhaust ducts carrying noxious or corrosive fumes must be under negative pressure; connect them on the suction side of the fan.

Keep fan discharge ducts as short as possible, and make them completely air-tight. One method of ensuring tightness is to line the duct with a coating that meets code and NFPA 90A requirements. Install flexible duct connectors on the fan discharge, taking special care to guard against leaks.

Provide a volume damper in each (supply and exhaust) branch duct.

For low pressure systems, limit the maximum air velocities and/or friction losses to the figures shown in Table I

Ductwork located in ceiling space near air handling device with filters is to be routed so that filter access/removal space is maintained.

Table 1. Maximum Duct Air Velocities and Friction Losses

Location	Velocity/Friction
Main supply	1800 fpm/0.08" per 100'
Main return	1800 fpm/0.08" per 100*
Main exhaust	2500 fpm/0.10" per 100'
Branch supply	1600 fpm/0.08" per 100'
Branch return	1400 fpm/0.08" per 100'

Branch exhaust	1800 fpm/0.10" per 100'
At supply outlet	750 fpm
At return/exhaust intake	400 fpm
Within the space	50 fpm

Use round ducts as much as possible. The aspect ratios for rectangular ducts must not be greater than 6:1, unless space is limited.

Install triple-vaned, full-radius turning vanes within 35' of the air handling unit discharge, within 10' of a FCU discharge, or whenever the velocity exceeds 2000 fpm. Where the velocity exceeds 2500 fpm, use five, full-radius turning vanes. Do not use turning vanes in exhaust or return ductwork.

Limit the reduction in area due to obstructions to not more than 10 percent. Streamline obstructions inside ducts. Limit transitions to a 15 degree slope on the upstream side and a 30 degree slope on the downstream side.

Install access panels for duct cleaning and the inspection or servicing of dampers, controls, or duct-mounted equipment. Install the panels in accessible locations. Panel sizes must be appropriate to the need and may be larger than the minimum sizes listed in Table 2.

Table 2. Minimum Sizes for Access Panels

Location	Minimum Size
Fire dampers	12"x12"
Combination fire and smoke dampers	12"x12"
Smoke dampers	6" x 6"
Automatic control dampers	6" x 6"
Manual volume dampers (2 sq ft and larger)	6" x 6"
Inlet side to all coils	12"x12"
Suction and discharge sides of inline fans	24"x 24"
At additional locations indicated on drawings, or specified elsewhere	12"x12"
Flow measuring stations	12"x12"

Install access doors within ductwork on both sides of fire dampers and duct-mounted coils, where possible.

Provide exhaust with heated make-up, as required, from hydraulic elevator machine rooms, sewage lifts, and neutralization rooms.

Ductwork is not usually lined.

Install ducts with the fewest possible joints.

Locate ducts vertically .horizontally, parallel, and perpendicular to building lines. Avoid diagonal runs. Install duct systems along the shortest route that does not obstruct useable space or block access for servicing the building and its equipment.

Provide a clearance of 1" where furring is shown for the enclosure or concealment of ducts. Allow for insulation thickness, where applicable.

Install insulated ducts with a minimum clearance of 1" outside of the insulation.

Provide 4" (100 mm) wide galvanized sheet metal collars at sleeves and prepared openings, sized to cover the entire duct penetration, including sleeve and seal, and to accommodate duct insulation, as necessary. Edges must have milled lips ground smooth and painted to match the duct finish.

Ductwork must be free from vibration under all conditions of operation.

No pipe, conduit, hanger, architectural element, or structural member may pass through any duct.

Do not route ductwork through transformer vaults or electrical equipment spaces and enclosures.

The maximum length of flexible duct is 6' (1800 mm).

Specify that duct system interiors be vacuumed to remove dust and debris before final acceptance.

Ductwork Design Plan Requirements

Identify on the plans the designated service/access area at each terminal unit, fan coil unit, and fire-smoke damper utilizing a shaded area on the floor plan.

Provide a detail clarifying that no piping, ductwork, conduit, and/or ceiling hangers are to be installed in the designated service/access area. The detail should also indicate that terminal units and/or fan coil units are to be installed no more than 18” above the ceiling (to facilitate ladder access).

Provide a detail clarifying that terminal units are to be installed with a minimum 24” length of straight duct at the inlet (10’-0” maximum length) at the same size as the inlet connection and with a minimum 48” length of lined duct at the outlet.

Coordinate access to all terminal unit and/or fan coil unit locations with light fixtures shown on the electrical drawings.

Review all duct and pipe routing with the architect and the structural engineer to ensure that the ductwork and piping (including fire sprinkler piping) will fit into the available space above the ceilings after allowing for electrical conduit, light fixtures, etc.

Locate duct static pressure sensors for control of supply fan vfd’s on the appropriate ductwork plan.

Review/coordinate fire/smoke damper locations with the architect and with the exiting plan. Route ductwork to minimize the required number of fire/smoke dampers.

Provide a single line duct drawing identifying the design cfm, velocity, and pressure drop (per 100 feet) in each section of medium pressure duct (upstream of terminal units).

MATERIALS

Galvanized Steel Supply, Return, and Non-Hazardous Exhaust Ducts

High-pressure ductwork must not be less than 24-gauge.

Low-pressure ductwork must not be less that 26-gauge.

Use the Ductmale, Nexus, or Transverse Duct Connection systems to join galvanized steel exhaust ducts.

Use duct sealant to seal galvanized steel exhaust ducts.

Exhaust ducts must be pitched whenever there is a possibility that water will collect in or on them.

Choosing Material for Fume Hood Ducts

Materials for fume hood ducts must be carefully selected. In most cases, Type 316 stainless steel is satisfactory. Use number 2B finish in concealed areas and number 4 finish in exposed areas.

Use Type 316 stainless steel for laboratory or fume hood exhaust. However, in severe applications, a more resistant material should be used.

Final selection should not be made without consulting UNLV's Office of Environmental Health and Safety.

Stainless Steel Ducts Used for Fume Hood and Hazardous Exhaust

High-pressure ductwork must not be less than 24-gauge.

Low-pressure ductwork must not be less that 26-gauge.

Stainless steel ducts must be sealed by providing welded joints and pitched so that moisture cannot collect in them.

Fabricate fume hood ductwork in accordance with SMACNA requirements. However, do not cross-break. Increase the gauge to provide a gauge that is 0.5 lbs/sq ft (2.5 kg/m2) heavier than standard.

Stainless Steel Ducts Used for Non-Hazardous, Moist Air

Use stainless steel ducts for collecting non-hazardous moist air, such as dishwasher or shower room exhausts. Use Type 304 stainless steel for the following:

For all ductwork outside the building

For all ductwork outside dishwasher and shower rooms

15 feet downstream of humidifiers and dryer exhausts

For any duct containing more than 25percent air from a shower

Use number 2B finish in concealed areas and number 4 finish in exposed areas.

High-pressure ductwork must not be less than 24-gauge.

Low-pressure ductwork must not be less that 26-gauge.

Stainless steel ducts must be sealed using duct sealant and pitched so that moisture cannot collect in them.

Additional Materials Requirements

Use stainless steel for exhaust ducts, from inlet to discharge, for glass washers, dish washers, cart washers, and cage washers. Joints must be welded, and the ducts must be pitched to drain.

Kitchen grease exhaust ductwork must be of 16-gauge, welded steel construction, and pitched to meet code and NFPA 96 requirements.

Use galvanized steel for all supply and return and non-hazardous, non-moisture-carrying exhaust ductwork. The ductwork must have a galvanized coating of G-90 (G-60 is not acceptable).

All dampers installed in fume hood exhaust systems must be of same material as the duct.

Provide the proper pressure and leakage-rated, gasketed, and duct-mounted access doors or panels.

In insulated ducts, access doors must be insulated, double-wall doors.

Door material gauges, the number of hinges, and the number and type of door locks must meet SMACNA duct construction standards.

Unhinged doors must be chained to the frame with at least 6" of chain to prevent loss of the door.

For seal Class A. hinged doors and screwed or bolted access panels are not acceptable.

Access doors must be leakage-rated, neoprenc-gasketed, UL 94 BF1 listed, DUCTM ATE Sandwich doors.

Door metal must be the same as the attached duct material.

For grease and high temperature ducts, the door assembly must be rated for 2300°F.

INSTALLATION GUIDELINES

Do not route fume or kitchen exhaust through fire walls.

Keep ductwork routed outdoors and across roofs to a minimum; route ductwork within the building as much as possible. Any design requiring ductwork to be exposed above a roof requires written approval from UNLV Planning and Construction.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

Systems with a Design Static Pressure of Less than 2" Positive or Negative
Before installing exterior duct insulation, test all supply, return, and exhaust ductwork for air leakage. Conduct the tests per the latest edition of the SMACNA HVAC Air Duct Leakage Test Manual. The test

pressure must be 25 percent greater than the design duct operating pressure. The total allowable leakage must not exceed 5.0 percent of the total system flow. When partial sections of the duct system arc tested, the summation of all sections must not exceed the 5.0 percent total allowable leakage for the system. The test must be witnessed by an independent testing agency.

Systems with a Design Static Pressure of More than 2" Positive or Negative
Before installing exterior duct insulation, lest all supply, return, and exhaust ductwork for air leakage. Conduct the tests per the latest edition of the SMACNA HVAC Air Duct Leakage Test Manual. The least pressure must be 25 percent greater than the design duct operating pressure. The total allowable leakage must not exceed 1.0 percent of the total system flow. When partial sections of the duct system are tested, the summation of all sections must not exceed the 1.0 percent total allowable leakage for the system. The test must be witnessed by an independent testing agency.

Cleaning and Adjusting
Specify that all ductwork and plenums be cleaned when the job is turned over to UNLV. In special areas where extreme cleanliness is required, specify that ducts and plenums be vacuum-cleaned. Before consideration of acceptance of the duct systems or plenum inspection, acceptance by UNLV's job coordinator is required.

SECTION 15836

AXIAL FANS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for supply, return, and exhaust system fans.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General

Base fan size selections on the manufacturer's published sound level, effluent exhaust, and/or cfm and static pressure requirements.

Specify that protective coatings be applied to components in or out of the airstream (or both) to resist chemical attack and corrosion.

Specify whether the fan rotation arrow must be shown as part of the manufacturer's unit or installed by the contractor.

Select all scheduled fan motor sizes, 1/2 hp and larger, as follows for supply fans, return fans, and exhaust fans to provide for increasing the rpm above design, if necessary.

Using design air quantity and static pressure (adjusted as necessary for altitude, temperature, fan inlet restrictions, discharge conditions, and system effect factors), select a fan from fan curves that will operate well within the stable range at a reasonable static efficiency. Note fan speed.

Add 10 percent, but not to exceed 3/4 inches of water, to design static pressure. Using the same design cfm, check for satisfactory operation of the fan. Note the fan brake horsepower required to prevent overloading at any point on the fan curve.

Select outlet velocities and fan tip speed for quiet operation. Higher outlet velocity and static pressure result in increased sound output. Balance cost and space against sound and efficiency. The fan manufacturer's catalog should be consulted for outlet velocities and fan tip speed.

The largest single factor causing poor fan performance is a poorly-designed inlet connection. A poorly-designed inlet connection will often reduce the fan capacity by 30 percent without appreciably changing the horsepower. Poor fan discharge duct connections can reduce capacity. See the SMACNA duct design guide for fan inlet and outlet system effect factors that contribute to fan performance loss and increased noise.

Verify that fans have been isolated from the building structure.

Use flexible connectors to isolate all fans connected to ductwork. Use flexible conduit to connect the electric motor to the power source.

Fan performance curves are based on dry, "standard"' air at 70°F at sea level. Include temperature and pressure corrections when operating at other conditions. (Note: kitchen fans operate at high temperatures.)

Explosion-proof construction must include an explosion-proof motor; explosion-proof disconnect switch; static resistant belts; and an aluminum, non-sparking wheel.

All fans must be statically and dynamically balanced individually by the manufacturer to within 1 mil double amplitude at 125 percent of the rated speed.

Use direct-drive fans with variable frequency drives whenever possible (depending on the airstream) to avoid losses and maintenance associated with belt-drive units.

Centrifugal fans must meet the class requirements of project design, with a minimum Class II.

Fans 50 hp and over must have fixed-pitch sheaves on the fan and motor.

Select fans to operate well within the critical limits of the shaft and bearings.

Air handling unit supply and exhaust air fans serving laboratories must be redundant.

Fans used for fume hood and other contaminated exhaust must have bearings, drives, motors, and all controls located outside the airstream. Fans serving such systems must not be interlocked with the supply units.

All fans that will exhaust fume hoods must be non-sparking and must be either coated steel (Heresite, PVC) or of corrosion resistant construction.

Laboratory exhaust systems must use redundant, high-plume blowers.

Perchloric fume exhaust fans must be of non-sparking construction.

Forward-curved fan wheels can deliver large volumes of air at slow speeds and a steep brake horsepower curve and can be overloaded if the static pressure drops. Where noise might be a factor, use forward-curved fan wheels up to 20" in diameter. Because of its curved shape, a forward-curved fan wheel cannot be used where there is foreign material present in the air that would lodge in the blade cup. Forward-curved fan wheels are used primarily in small ventilating fans, with lower pressures, where the use of a backward-inclined wheel would create too high an operating speed for the bearings. A backward-inclined fan wheel gives the fan a flat horsepower curve, and proper fan motor selection will never cause it to be overloaded.

As a general guideline, use forward curved fans for systems less than 12,000 cfm and less than 4" total design static. Specify air foil fans for conditions in excess of 16,000 cfm or 4" design TSP.

Provide sufficient room so that the fan and fan shaft can be removed.

Roof Ventilators

Avoid large roof ventilators servicing extensive duct runs.

Avoid the use of direct-driven roof ventilators with wheels in excess of 20" nominal diameter. Specify V-belt drive arrangements to provide for flexibility.

Specify shaft seals to prevent the entry of contaminated exhaust air into the motor compartment.

Specify a non-fused, disconnect switch in an appropriate enclosure (to suit environmental conditions), mounted adjacent to the motor.

Specify mesh size, material, and function to exclude the entry of birds or insects.

Specify dampers for use with roof ventilator fans.

Specify an aluminum, felt-edged damper that opens when the fan is started and is closed by gravity when the fan is shut off. Do not use gravity dampers when local wind conditions or stack effect will cause the damper to chatter open and closed.

Specify electric motor-operated dampers when positive and tight closure is necessary.

Specify a hinged sub-base for wheel diameter sizes through 36". For larger sizes, specify a mounting pedestal with a removable access panel.

The roof curb manufacturer must be same as the roof ventilator manufacturer. Include the type of material in the specification.

Utility Vent Sets
See the information above for forward- and backward-curved fans.

Double-Width Inlet Fans
Allow one fan diameter between the fan and side wall casing and two fan diameters between adjacent double-width fan inlet collars.

Propeller Fans

Limit the use of propeller fans to locations with low static pressures and where noise is not a factor. Propeller fans handle large volumes of air at low static pressures and low power consumption. The use of ductwork adversely affects their efficiency, greatly reduces the volume of air they will handle, and increases power consumption.

When propeller fans must operate against an appreciable resistance, and when running at high speeds, they are generally not suited for quiet operation due to high tip speeds.

Inline Fans

Centrifugal In-Line Fans
The wheel may have forward- or backward-curved blades. Forward-curved blades generally produce less head and are economical at low static pressure and low capacity. Backward-curved blades are the most efficient. Centrifugal in-line fans are well-suited for use at high static pressure and high capacity. A variation of the backward-curved blade has an airfoil cross-section that produces quiet and efficient operation in its range, and is well suited for high pressure and high capacity use.

Axial In-Line Fans

Because of the air turbulence in this type of fan, axial in-line fans are not recommended for quiet operation at high capacity, without providing fan silencers.

Vaneaxial In-Line Fans

Vaneaxial fans are similar to axial in-line fans and are provided with flow vanes. Vaneaxial fans are well-suited for high pressure and capacity use and are most suitable for variable-volume and/or variable-pressure systems. Sound attenuation is usually required for this type of fan. Vaneaxial fan airflow may be controlled by an adjustable blade pitch or variable frequency drives.

Centrifugal Fans

Centrifugal fans must have welded steel housings and wheels balanced dynamically and statically.

Provide V-belt, variable-pitch drives, with spring-loaded belt tensioners, for ±10 percent speed variation.

Fans must be equipped with backward-curved blades connected to an electric motor so that in no instance can the fan motor be overloaded at the capacities shown on the drawing schedule. Provide an open, drip-proof motor on an adjustable base.

Provide V-belt drives sized as recommended by the manufacturer. Belt construction must be rubber and cord. Belt sets must be matched for length. Belt capacity must be 150 percent of the motor horsepower rating. Belts must be stamped A- or B-type. Sheaves must be cast and machined iron steel larger than the minimum diameters recommended for a particular belt. Sheaves must be dynamically and statically balanced.

Provide belt guards of 18-gauge steel mesh, perforated steel sheets, or expanded steel sheets, with angle frames and galvanized steel or rigidly-braced iron trim.

Provide ports for tachometer speed measurements at the fan shaft.

Provide spring vibration isolation bases.

Provide seismic isolation as required by code.

Provide an inlet screen, bolted access door, bearings with an L-10 life of 200,000 hours, and anti-corrosion coalings.

Fan shall be selected not to exceed 1200 rpm.

Centrifugal Roof Exhausters

Provide V-belt (dome, low-silhouette, or penthouse), variable-pitch, belt-drive fans certified to bear the AMCA seal.

Provide a 12" high, pre-fabricated aluminum roof curb with a lining that provides at least 30% sound reduction.

Provide the following components:
- Gravity backdraft dampers
- Bird screen
- Spun aluminum housing
- Disconnect switch
- Inlet venturi orifice
- Vibration isolation
- Permanently-lubricated ball bearings
- Enclosed, fan-cooled motor
- Junction box
- Belt drives must have ±5 percent speed variation and a spring-loaded belt tensioner. Direct drives

must have speed controllers in the junction boxes.
- Fan must be selected not to exceed 1200 rpm.
- Centrifugal In-Line Fans

The tubular housing must be heavy-gauge steel, all-welded construction. Provide a bolted and gasketed full-access door with a "swingout" clamshell design to permit inspection or removal of the fan impeller.

The fan wheel and drive assembly must be statically and dynamically balanced at the factory.

V-belt capacity must be 150 percent of the motor horsepower rating. Fan motor pulleys must be adjustable-pitch pulleys. Provide an adjustable motor base. Provide an OSHA-approved belt guard for drive components that are located outside of the fan housing.

Provide ports for tachometer speed measurements at the motor shaft.

Provide self-aligning bearings with a minimum L-10 life of 200,000 hours.

Provide extended lubrication lines.

Fan must be selected not to exceed 1200 rpm.

Extra Materials
- Specify one spare belt set for each type of fan.

SUBMITTALS

Submit the following design and certification documentation.

Designer Submittals
Submit fan selection calculations.

Product Certificates Signed by the Manufacturer
The manufacturer's representative must check each fan of 25 hp and over for proper installation, alignment, belt tension, and operation. The manufacturer's representative must submit a written report to the engineer, with a copy to UNLV, stating that at the time of the report, the fan is running properly and is acceptable to the manufacturer in every respect.

PRODUCT STANDARDS

Products must conform to AMCA standards—certified and sealed.

Manufacturers
Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

General Supply and Exhaust Fans
- Greenheck
- Loren Cook
- Twin City Fans

High-Velocity Roof Exhausters for Laboratory Exhaust
- Strobic
- Twin City Fans

- Greenheck

Blowers
- Penn-Barry
- Twin City Fans
- Aerovent
- Greenheck
- Cook

Accessories or Special Features

Provide fan guards for the motor side and the discharge side of propeller fan installations less than 7' above the floor. Provide expandable wire mesh on the intake and motor-operated shutters on the discharge to protect the fan and building interior against rain, snow, and sleet intake when the fan is off. Motorized shutters prevent wind pressure from chattering when the fan is off.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

END OF SECTION

SECTION 15840

AIR TERMINAL UNITS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for constant- and variable-volume air terminal units.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Verify that VAV boxes can provide turndown to the minimum set-point cfm when the system static pressure decreases.

Do not oversize VAV boxes in an attempt to decrease sound power output.

Decreased airflow across the velocity sensor can produce erratic readings at low flow.

Consider series-type, fan-powered boxes in lieu of parallel-type boxes for interior spaces. Series boxes provide constant air circulation. Fan and motor noise is also less noticeable than with on-off or parallel-type boxes.

Schedule the following:

- Minimum and maximum air flows
- NC level, discharge and radiated
- Duct inlet and outlet sizes
- Motor horsepower and power requirements

Show power connection to VAV boxes.

Equipment

Air terminal units must be 24-gauge galvanized steel, lined with 1-1/2 pound insulation as required by UL-181 and NFPA-90A. Insulation must be covered with hospital-grade Mylar® or foil meeting NFPA fire and smoke requirements.

Provide a damper motor suitable for electronic (DDC) control.

Responsibilities for providing a damper actuator and DDC VAV box controller, including a velocity pressure transducer and control transformer, are described in Section 15950: Energy Management and Control Systems. The terminal box manufacturer must include with their bid the costs of mounting the controller on their box and piping the controller's transducer to their flow sensor (in accordance with the control manufacturer's instructions).

Provide 3' long sound attenuators and a hot water reheat coil. Provide an access door at the reheat coil section, before and after the coil.

Boxes must have multipoint averaging-type airflow sensors.

The contractor must include the following items with the shop drawing submittal:

The name of the terminal box manufacturer.

The name of the temperature controls manufacturer.

A statement that the mechanical division contractor has contacted both vendors and verified that the terminal box and VAV DDC controller are compatible with each other and that they can perform all sequences of operation shown on the control drawings.

Provide power to VAV boxes using 24 volt transformer or line voltage as required.

Provide discharge air temperature sensor at each VAV box.

Schedule/specify VAV boxes for a total air pressure drop of no more than .60" w.c. (combined pressure drop thru both damper and reheat coil) and with reheat coils selected to ensure a discharge air temperature not lower than 85°F.

Schedule/select terminal units with maximum, minimum, and reheat cfm values of 100%, 20%, and 50% respectively.

Schedule/select terminal units with a total air pressure drop of .60"w.c. or less (total pressure drop to include the combined air pressure drop thru both the damper and the reheat coil). It is somewhat customary to select reheat coils such that the leaving air temperature is not lower than 85°F. Terminal units should also be selected with an inlet velocity between 1700 and 2300 fpm (2000 fpm plus or minus 15%) to ensure controllability at the minimum and reheat cfm set-points.

Provide notation at terminal unit schedule(s) to require that each terminal unit be provided with a bottom access panel (to allow for access to the inlet side of the reheat coil) and with four threaded rod hanger brackets. Titus is one of the manufacturers that offers these options in their catalogue.

Utilize a numbering scheme that provides a unique number/designation for each terminal unit that is associated with the corresponding air handling unit VAV 1-1 thru VAV 1-20 for AH-1 and VAV 2-1 thru 2-20 for AH-2, etc).

Incorporate a summary calculation line in each terminal unit schedule that lists the total of the maximum cfm values and the total of the reheat coil gpm values for each air handling unit.

Provide notation requiring that each terminal unit is to be configured with the disconnect, control enclosure and piping connections located on the same side of the unit.

PRODUCT STANDARDS

Products must conform to the following standards:
- NFPA 90A
- UL181
- NEMAI

Manufacturers
Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:
- Trane
- Metalaire
- Titus
- Carrier

INSTALLATION GUIDELINES

On drawings, show access space for the VAV box control panel, damper actuator, filter, fan motor, and reheat valve.

Designate a 36” by 36” service/access area at each VAV box (boxes no more than 18” above ceiling)

Require electrical disconnect, control enclosure, and reheat coil connections to be located on the same side of each vav box (to allow for access from a single service/access location).

On drawings, show the access door downstream of the reheat coils.

On drawings and in specifications, indicate that a minimum of 2-1/2 duct diameters of straight duct must be maintained for flex duct entering the VAV box.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

END OF SECTION

SECTION 15855

DIFFUSERS, REGISTERS, AND GRILLES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for covers, diffuser, grilles, registers, and intake and discharge louvers.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Supply, Return and Exhaust Outlets

Equipment must handle air quantities at operating velocities. Select and apply the air distribution apparatus so that the temperature in the occupied zone varies no more than ±2°F.

Air motion in the occupied space must be between 25 and 45 fpm over the full control range of the variable-volume controller.

The noise criteria level in the space must be no greater than that scheduled on the drawings and 30 noise criteria where not scheduled.

The supply diffuser must be located in the center of the room and uniformly placed in the center of tiles and in logical patterns that include lighting, sprinklers, and other similar types of equipment.

Damper shall be placed at duct branch line off main feeding diffuser or 10 ft minimum from diffuser.

The return or exhaust grille may be located anywhere (with the exception of laboratory fume hoods) in the room, but as far as possible from the supply outlet. Give special attention to laboratory supply diffusers with fume hoods. The location of all supply diffusers must minimize the creation of eddy currents in the fume hood that could spill the fume hood's contents into the laboratory. The velocity of the air in front of the fume hoods must be less than 50 fpm or 1/2 of the hood face velocity.

If fin tube radiation is not used (with permission from the UNLV Project Manager and Facilities group), then the supply diffuser must be located on the outside walls and be of the linear type.

Air Intakes

Size all intakes to provide an air velocity of 600 fpm or less. Louvers reduce the free area by at least 50 percent and usually much more. Size and locate intakes to prevent the entrance of light fluffy snow (intake •velocity < 250 fpm) and polluted air peculiar to the building site.

Intakes near or below ground level not permitted. The minimum height of the bottom of intake must be:
- 6' above grade
- 3' above the roof

Examine intake locations for proximity to contaminated air exhausts, such as laboratory discharges.

All intakes must have a 1/2" mesh wire screen on the outside or as required by code.

Equipment

Each grille, register, and diffuser provided must have the accessories necessary to perform satisfactorily and to be fully adjustable, including opposed-blade volume dampers operable from the front, air deflectors, vanes, blanking quadrants, and similar components. At each inlet and outlet device, provide accessories to accomplish the positive regulation of air volumes and the uniform distribution of airflow over the outlet.

Supply registers must have two sets of directional control blades.

Diffusers within same room or area must be of same type and style to provide architectural uniformity.

Diffusers should be full-size for 24" x 24" tiles or half-size (24" x 24") for 24" x 48" tiles.

Provide surface-mounted diffusers, registers, and grilles with gaskets. Installed them with faces set level, plumb, and tight against the mounting surface.

The architect will determine the finish.

Additional Requirements

Avoid the use of perforated ceilings for the air supply. If such a system seems unavoidable, consult with the UNLV Facilities Management group before designing the installation to discuss specific requirements.

Supply registers and grilles must be double-deflection type.

Where possible, ceiling diffusers must be adjustable for air pattern.

All registers and grilles must be equipped with appropriate setting frames. Ceiling-mounted devices must match ceiling type.

As a rule of thumb, decrease the selected noise criteria level of selected diffusers by 3 db for every doubling of the number of diffusers in the space.

Minimum throttling cfm to avoid dumping:

Perforated diffuser not lower than 0.7 cfm/sq ft

Linear diffuser not lower than 0.3 cfm/sq ft

Architectural diffuser not lower than 0.3 cfm/sq ft

State in the specification state that the contractor must adjust linear diffuser air directional vanes.

SUBMITTALS

Submit schedules on the drawings of all air distribution apparatus. List the following data in the schedules:
Item number, location, and/or area served

- Style or model
- Listed size
- Cubic feet per minute, SP
- Noise criteria
- Throw
- Drop (where applicable)

- Plan symbol
- Material
- Finish
- Any remarks

Rooms that have pressure requirements different from adjacent rooms must show the relative room pressurization airflow drawing. The airflow drawing must show the supply diffusers, exhaust or return grilles, and fume hoods (if any), including the cfm capacity for each unit.

Manufacturers
Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

- Titus
- Metalaire
- Krueger

MATERIALS

Do not use expanded metal or stamped or formed grilles, unless the air intake size is sufficient to provide a velocity of 600 fpm or less and to prevent snow draw through the louver or grille under maximum air flow conditions.

INSTALLATION GUIDELINES

Do not locate registers or grilles in the floor, unless project calls for a raised floor application.

END OF SECTION

SECTION 15861

AIR FILTRATION

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for disposable, extended surface, roll, activated carbon, and HEPA air filtration systems.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Understand the function of the facility and the needs of UNLV and the facility users, as well as the source of outdoor air drawn into the facility for ventilation.

Meet with UNLV Planning & Construction and the facility users to obtain specific data and information about the nature, concentration, particle size, and distribution rate of airborne contaminants generated within the facility.

Meet with UNLV Planning & Construction and the facility users to obtain specific data and information about the nature, concentration, particle size, and distribution rate of outdoor contaminants, such as auto pollution, construction dust, contaminants from cooling towers, and vegetation.

Consider:

Whether a filter with high moisture resistance is needed

Pressure drop for energy performance

Cost and ease of filler disposal for UNLV

Select the minimum efficiency-reporting value (MERV) filters necessary to effectively filter particles sizes and gases encountered. Include MERV designations in specifications along with the expected final resistance value.

For low efficiency selections, use ASHRAE 52.1 for information on arrestance, which ASHRAE defines as the percentage of test dust, by weight, that a filter can capture. Use this standard to determine the dust-holding capacity service life of the filters.

Select absorbents for gas-phase chemical control. Specify with test coupons.

In some cases, design conditions might require more efficient filtering than that afforded by non-HEPA filters. In such cases, discuss filtering needs with the UNLV Facilities group and facility users before selecting the air filters.

Specify pleating, pocket attachment, framing, and surface area for best dirt holding capacity, pressure drop, and life-cycle use.

Select the filter retaining devices and sealing materials—gaskets and seals—to withstand air stream contaminants and ensure that there is no bypass around the filter.

Oversize filter banks as much as possible to increase filter life-cycle and decrease fan energy.

Do not expose filters to moisture, which can shorten filter life and weaken the filter support structure. Determine whether specialized filters are needed for moist, ambient conditions.

The design face velocity should not exceed 500 fpm for all filters.

Provide the following for all systems handling 200 cfm or more and for all high-efficiency applications, regardless of size:

Primary air filters (pre-filters) must be UL Class 2, 2" thick, pleated, fabric filters. Efficiency must be 35 to 50 percent as measured by ASHRAE test standard 52-76. Design filters to operate up to 500 fpm.

MERV 6: 35 < E3 < 50, minimum final resistance of 0.6" wc.

Secondary filters (final filters) must be UL Class 1 with an efficiency of 90 to 95 percent as measured by ASHRAE test standard 52-76. Design filters to operate up to 500 fpm.

MERV 14: 75 </= EI 85, 90 < E2,90 </= E3; minimum final resistance of 1.4" wc.

SUBMITTALS

Submit the following design and testing documentation.

Designer Submittals

Air contaminants

Filter selections

Contractor Submittals
Submit a gas phase filtration test coupon testing report.

PRODUCT STANDARDS

Products must conform to the following standards:

Underwriters Laboratories Class 1 or 2
ASHRAE 51
ASHRAE 52

Manufacturers
Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

- Filter Sales
- Air Technology
- Farr
- American Air Filter

Accessories or Special Features

Provide filters with a Dwyer magnehelic filter gauge across each filter bank, equipped with an adjustable flag to indicate the need to change filters.

Dirty filter alarms must be taken back to the building automation system.

The preferred filter face dimension is 24" x 24".

INSTALLATION GUIDELINES

Provide access to filters. Ensure that piping, ductwork, and electrical system components do not block access. If installing an air handler in a ceiling space, locate it where the filter access or removal space is away from ductwork.

Do not allow the air handling system to be operated during construction without all panicle filtration in place. Construction dirt, dust, and debris can accumulate in ductwork and lead to indoor air quality problems.

Extra Materials
Specify the number of filters to be used during construction, plus one additional filter set to be installed at the end of construction.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict

With commissioning procedures for testing and training.
Use coupon test strips for gas phase filtration.

Provide minimum of 2" 6" clearance space to change fillers.
Start-up and Training
Include the following statement in the specifications: "The contractor is responsible for installing new filters throughout the system immediately before the completion of all contract work."

SECTION 15880

AIR DISTRIBUTION

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for air distribution systems.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Filtration
All filter systems must operate with 55% efficiency or greater. Unique filtering systems, for dedicated operations, must operate independently of the building's main system and provide efficiency ratings as needed for the application.

Fan Tip Speed
As a sound control measure, fan tip speed shall not exceed 55 feet per second.

Fan Mounting
Fan casings shall be resiliently mounted to minimize noise and vibration. Fan mounting shall comply with the more stringent of the latest ASHRAE standard or the manufacturer’s recommendation.

Laboratory Ventilation System

Ventilation. For each project, a life cycle cost analysis shall be performed to compare constant volume type fume hoods and variable volume systems, and other appropriate technologies, to determine the life cycle costs for each type of system. The analysis will consider energy costs, other operating costs, maintenance costs and initial capital costs. The results shall be reviewed by UNLV.

If the analysis indicates a payback of ten (10) years or less for the variable volume system, that system should be specified.

If a variable volume system is chosen, it shall have an occupant sensor for each fume hood which will reduce air flow to a minimum level when the hood is not in use.

For all variable volume systems, the fume hood shall have a local override control that will permit the operator to run the hood air volume to its maximum rate.

Variable air volume systems controllers must be integrated with the campus controls system. The system shall provide BACnet interface capabilities. Variable air volume systems shall have pressure independent airflow control valves suitable for up to 3” w.g. pressure drop.

Variable volume control system must react within 3 second to changes in air flow.

Fume hood average face velocities shall be a minimum of 80 fpm at the design sash position of 16” with no individual face velocity measurement less than 65 fpm. All hoods must be tested both in the factory and on-site in accordance with ASHRAE 110. Fume hood designs that demonstrate as installed containment with an average face velocity of less than 80 fpm, such as low flow constant volume hoods, can be considered with approval from Facilities Services and EH&S; however, average face velocities at the design sash position shall be at least 60 fpm. In addition to meeting the requirements of ASHRAE 110 as installed, hood field certification by EH&S is required before being turned over for service to the user.

All fume hoods shall have a flow indicator installed which has both an audible and visual alarm for low flows.

All fume hood exhaust ducting shall be made from 16 or 18 gauge 316 stainless steel with screwed slip joint connections sealed with a n appropriate sealant such as polysulfide. Facilities Services will determine if welded 'TIG' joints are required based on the laboratory materials and use planned for the fume hoods. (Type 316L must be used if welded joints are specified.)

Additionally, Facilities Services will review alternate duct materials such as galvanized steel if proposed.

Fume hood exhaust shall not pass through unducted areas. Exhaust ducts shall always be at a negative pressure with regard to ambient.

All exhaust fans shall be located outside of the building on the roof or in a dedicated penthouse mechanical room with its own independent ventilation. All motors shall be outside of the duct and be of spark-proof design.

Laboratories with fume hoods shall maintain a slightly negative air pressure with regards to non-laboratory areas. Biosafety level 3 & 4 laboratories require a minimum of -0.03 5o -0.05 w.g. differential between the laboratory and adjacent areas.

The fume hood and ducting shall have materials with a flame spread rating of 25 or less, per NFPA method 255.

Fume hood exhausts shall extend above the building roof at least seven (7) feet to prevent personnel exposure and re-entrainment unless modeling demonstrates a higher point of discharge. Air dispersion modeling shall be done for new installations with two or more fume hoods.

Fume hood exhausts should be located at least fifty (50) feet away from any supply air intakes. Exhaust discharge velocities shall be 3,000 fpm to prevent personnel exposure and re-entrainment unless modeling determines a different value is required. This requirement does not negate the need to perform air dispersion modeling. Mixed-flow exhaust fans shall be considered in addition to centrifugal fans.

The minimum air changes for laboratories are six (6) changes per hour (ACH) for occupied conditions and four (4) ACH for unoccupied conditions. Supply air is 100% outside air. Variable volume (and constant volume) systems should be designed to have some capability for additional ventilation rates beyond the design level. Facilities Services and EH&S will work with the design team on what additional capacity is feasible for each zone. For a single lab which is served by a single, dedicated make-up air unit and the cooling load cfm exceeds the required exhaust cfm, a make-up air system with outside air and return air is acceptable provided however that the 6 ACH minimum cfm rate required must be outside air.

Fume hoods shall not have automatic sprinkler systems or fire detection devices installed in them unless specifically required by the authority having jurisdiction.

Heat recovery systems for room and/or laboratory fume hood exhaust shall be considered and a life cycle cost analysis should be performed to determine if the heat recovery system has a payback of ten (10) years or less, Heat recovery for fume hood exhausts shall be 100% cross contamination free between the two air stream.

SECTION 15890

DUCTWORK

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains general design criteria for Ductwork.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

References
All ductwork system installation shall comply with the current SMACNA standards for low and medium velocity ductwork systems.

Main Ducts
Air velocity in main ducts shall be kept below 1500 feet per minute to minimize noise.

Room Discharge
Air velocity discharging from supply registers or entering return registers shall be not exceeding 400 feet per minute.

Duct Layout
Ducts shall be laid out to prevent “cross talk” between rooms. This is especially important in groups of classrooms.

Flexible Duct
Flexible ductwork shall not exceed 6 feet in length.

Fiberglass Ductwork
Preformed fiberglass ductwork is not acceptable.

SECTION 15950

TESTING, ADJUSTING AND BALANCING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains standards and guidelines for testing, adjusting, and balancing mechanical systems.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Who Performs
Testing, adjusting, and balancing (TAB) shall be performed by an independent testing agency. The project shall provide an allowance for UNLV to hire an independent testing agency. The test and balance agency will visit the project during the installation of the HVAC system.

Witnessing
No work shall be done unless the TAB firm is accompanied by representatives of the UNLV Facilities Maintenance HVAC shop. The TAB firm shall give the UNLV Office of Planning and Construction three working days notice prior to beginning work. If the TAB firm fails to coordinate with UNLV and performs work, this work shall be repeated, with UNLV representation, at no cost to UNLV. The Contractor may have representatives accompany the TAB.

Deficiencies
Deficiencies uncovered during TAB shall be corrected at no cost to UNLV.

Specifications must provide for the balancing and adjusting of all air, hot water heating, and chilled water cooling systems.

Balancing specifications must require written reports on the design and actual capacities of pumps and fans, motor voltage, amperage, rpm, and the design and performance of terminal units.

Air balancing must be done by a balancing contractor, not by the mechanical or sheet metal contractor. Preliminary balancing is the responsibility of the mechanical contractor. Final balancing of the system must be performed by an approved balancing contractor selected by UNLV. Include a statement in the base specifications that the mechanical contractor must provide additional mechanical equipment and/or features, such as turning vanes, volume dampers, splitter dampers and duct scaling, as determined by the approved balancing contractor for proper system balancing.

On large jobs, UNLV contracts directly for all air balancing work. Determine whether this will be the case on a given job by conferring with the University of Nevada/Las Vegas Facilities group before writing the specifications.

As soon as possible after the TAB contractor is selected, specify that the TAB contractor must review the contract documents to ensure that the design intent is completely understood, identify potential balancing problems, and develop a written report that outlines the balancing procedure and lists areas of concern. The contractor must also examine the drawings for potential balancing or other problems that might affect future HVAC system operation.

Specify that a meeting must take place at job site before commencing test and balancing work. Meeting attendees must include the TAB contractor, design engineer, and mechanical contractor. The purpose of the meeting is to ensure that all attendees completely understand system operation and participate in designing and building a balanced and properly-controlled HVAC system. If commissioning is included in project scope, coordinate with the commissioning authority.

Quality Control Testing

Product Certificates Signed by the Contractor

Include a copy of the certificate and a list of calibrated instruments, with date of calibration, in the balancing report.

At least one supervisor of the balancing firm must be certified by the National Environmental Balancing Bureau (NEBB).

Suppliers
The air and hydronic systems balancer must be a NEBB member. Do not use air-balancing contractors with only Associated Air Balance Council (AABC) membership. Only NEBB contractors provide the quality of work required by UNLV. NEBB requires that all testing instruments must be calibrated.

QUALITY CONTROL

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section.

Verify that the systems and equipment identified in this section of the standards and listed in the project specifications do not conflict with commissioning procedures for testing and training.

SECTION 15990

BUILDING AUTOMATION SYSTEMS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

A. This section contains design criteria for the BAS/EMS Control Systems.

B. Honeywell International, Inc. are required to review all plans and specifications pertaining to Building Automation Systems prior to issuance from the consultants. This review is to prevent inconsistencies during construction and to expose any communication issues.

C. A pre-construction and pre-installation meeting for Building Automation Systems must be conducted to coordinate with all involved trades and the owner.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

A. Use of Building Automation Systems
   1. Every building shall be evaluated for the use of Building Automation. Final decision regarding the installation and integration of Building Automation shall be made by the UNLV Office of Planning & Construction.

B. Building Automation Standardization
   1. The UNLV campus uses Honeywell Building Automation/Enterprise Building Integrator as the standard Building Automation Control System. UNLV is satisfied with the equipment and the technical support provided by Honeywell International, Inc. A standard system is used to reduce the inventory of spare parts and training of personnel. Buildings are managed and controlled from a central server computer system located in UNLV Network Operations Center. All Building Automation Systems are to be managed and maintained with a direct interface to this existing server system.

C. Connection to the Enterprise Building Integrator (EBI) central server computer system.
   1. Every building with Building Automation is to be connected to the EBI central server computer system, providing remote management and operation of the integrated systems. The preferred method is by utilizing UNLV campus network system. The project will provide all work, cable, accessories, and equipment required to connect between the EBI and the Building Automation system. All work to be performed must meet UNLV OIT Standards and scope of work provided prior to proposal.
      a. The EBI graphical representation of integrated systems and database.
   2. All facility programming will become part of the database and must be maintained, each facility in the database will utilize the three letter designation and similar equipment nomenclature between the facilities. The database, depending on protocol, requires proprietary and open protocol software to create, modify, and maintain. Software used to work on database such as Honeywell Care, Honeywell Quick Builder, Tridium Niagra AX, Lonworks, are part of each project.
   3. All of the facilities Building Automation Systems are provided floor plans, mechanical single line, and integrated systems graphical representation providing live data and interaction to the systems. All graphics must be approved by UNLV FM Building Automation Department prior to uploading and programming in the facility model.

D. Systems Integration
1. All new facilities shall be provided with a system wide integration of network building systems. These systems include, but not limited to; Fire/Life Safety, Smoke Management, Laboratory systems, Lighting, Elevator monitoring, Domestic Water, Energy Metering.
2. All refurbish or retrofit projects with scopes of system wide conversions or system refresh shall include integration provisions as require to integrate existing systems into the Building Automation System. These systems include, but not limited to; Fire/Life Safety, Smoke Management, Laboratory systems, Lighting, Elevator monitoring, Domestic Water, Energy Metering.
3. Each DDC panel must be modular in design to provide expansion capabilities for system expansion. Each DDC panel will utilize MSTP or IP to communicate between each controller and subordinate controller providing a seamless system. The main controller, typically the mechanical plant controller, will be connected to the UNLV campus network system to fully communicate with the EBI.
4. UNLV Building Automation system primarily utilizes the following system protocols; Bacnet MSTP or IP, Lon MSTP or IP, or Modbus MSTP or IP. Any other protocol must be approved by UNLV FM Building Automation Department prior to use.

E. Data Generation
1. The EBI/Building Automation Systems shall provide the ability to trend any data point from 5 seconds to 1 hour averaging intervals and up to 1 full year.
2. EBI occupancy scheduling shall provide the ability to create global schedules and temporary overrides. Each schedule will provide the ability to add resources from multiple facilities. The operator interface will be a calendar interface to adjust schedules and provide for temporary scheduling.

F. DDC Panel Locations
1. DDC panels will be located in an environmentally controlled area and at operator accessible height.
2. Areas inside roof, custodial closets, IDF rooms, or outdoor mounted air handler (other than those with designed accommodations for DDC panels) are unacceptable spaces. All DDC panel locations should be reviewed by UNLV FM Building Automation Department.
3. All space temperature controllers installed above ceilings will have 30x30x30 inches of clear space for working on controls, this will be indicated on drawings. No conduit, pipe, or cable tray may be installed through this area. Equipment valves and control panels shall be located on the same side of the unit.
4. Each controller will be labeled and drawings for integrated systems, exception is space temperature controllers. Each space sensor shall be labeled with associated controller.

EQUIPMENT AND INSTRUMENTATION

A. Installation
1. All equipment and instrumentation will be installed as directed by manufacturer installation instructions and in accordance with local building codes.
2. Any instrumentation with local device access, such as temperature sensor stations, differential pressure petcock, and air flow stations display shall be readable and physically accessible.
3. Any instrument/equipment requiring an analog convertor is unacceptable.
4. Preferred control interface is 4-20 ma, 0/2-10 V representing full range is acceptable.
5. No device, panel, or equipment other than conduit be installed on or through a motor control or electrical sub panel.
6. All devices exposed to outdoor conditions must be rated for such conditions and protected.

B. Recommended equipment and interface
   1. Chiller interface – all chillers will interface with the Building Automation System with Bacnet (preferred) or Lon MSTP or IP communications. UNLV FM will be provided the manufacturers declaration to select desired points to display on EBI. Hardware points will be included; enable/disable, status, and alarm.
   2. Boiler interface – all boilers will interface with the Building Automation System with Bacnet (preferred) or Lon MSTP or IP communications. UNLV FM will be provided manufacturers declaration to select desired points to display on EBI. Hardware points will be included; enable/disable, status, and alarm
   3. Variable Frequency Drives – N+1 systems do not require bypass. All VFD's must interface with Building Automation System via hard wire with following data points: Enable/Disable, Status, Alarm Status, Signal, and Feedback. Bacnet or Lon interface is approved for additional points such as energy, run hours, or additional alarm data. The application of using current sensors for status on VFD's is unacceptable.
      a. Approved manufacturers:
         - ABB
         - Dan Foss
         - Honeywell
   4. Damper Actuators – All damper actuators for air handlers shall be direct coupled. Smoke/Fire dampers will provide open/closed status to the Building Automation System.
      a. Approved manufacturers:
         - Honeywell (preferred)
         - Belimo
   5. Valve Actuators – All actuators within a subsystem, such as isolation valves, should be of same type, providing the same open/close timing to prevent un-intended performance issues in the systems. Where appropriate valves should be 2-way pressure independent type valves. Butterfly valves should be avoided for temperature control, limited to system isolation only.
      a. Approved manufacturers:
      b. Belimo (preferred)
      c. Honeywell

C. Instrumentation (general)
   1. Each system within the Building Automation System shall be evaluated to provide the necessary data points from instrumentation to ensure the system or equipment performance, operational requirements, and energy management is obtained. Instrumentation may include, but not limited to, temperature, humidity, air and water flow, and pressure.

INTEGRATION

A. Lighting Integration
   1. Lighting systems integration may include exterior and interior lighting. Lighting integration can be either Bacnet (preferred) or Lonworks MSTP or IP connection. Server to server bi-directional communications between EBI and Lighting server systems is allowed.
   2. Exterior lighting will provide scheduling as well as sunrise/sunset data input.
   3. Interior lighting will provide occupancy control and temperature set back.

B. Laboratory Integration
   1. All laboratories will interface to the Building Automation System via Bacnet (preferred) or Lon MSTP.
   2. The use of a gateway or similar interface to provide communications to the Building Automation system is not acceptable, Tridium JACE network device is preferred.

3. The following points and attributes will be provided at the EBI graphical interface:

Lab Interface to BAS (Volumetric Offset systems)				
SAV (Supply Air Valve)				
Supply CFM		Read only		Actual CFM valve is providing for temperature control
Offset		Read/Write		Maintains the proper balance of pressure in space
Supply Maximum CFM		Read/Write		Maximum cooling CFM set point
Supply Minimum CFM		Read/Write		Minimum cooling CFM set point
Cooling Demand		Read only		The actual cooling demand, displayed as 0 - 100
Heating Demand		Read only		The actual heating demand, displayed as 0 - 100, represents heating valve output
Mode		Read only		What mode Laboratory system in, Temperature control, unoccupied, etc.
Discharge air Temperature		Read only		Temperature of air supply
Current Lab Temperature		Read only		Laboratory temperature
Lab Temperature Set point		Read/Write		Laboratory temperature set point
Device Alarm		Read only		Display english text of alarms
GEV (General Exhaust Valve)				
Exhaust CFM		Read only		Actual CFM valve is exhausting, working inversly with HEV to provide proper pressure balance
Exhaust Maximum CFM		Read/Write		Maximum CFM set point, to maintain SAV offset
Exhaust Minimum CFM		Read/Write		Minimum CFM set point, to maintain SAV offset
Device Alarm		Read only		Display english text of alarms
HEV (Hood Exhaust Valve)				
Hood Exhaust CFM		Read only		Actual CFM valve is exhausting, working inversly with GEV to provide proper pressure balance
Face Velocity		Read only		Sash opening
Hood Exhaust Maximum CFM		Read/Write		Maximum CFM set point, to maintain SAV offset
Hood Exhaust Minimum CFM		Read/Write		Minimum CFM set point, to maintain SAV offset
Sash position		Read only		Monitors sash position
Flow Alarm		Read only		Loss of flow alarm
Presence Sensor		Read only		Monitors hood use
Device Alarm		Read only		Display english text of alarms
Laboratory Summary Data Display				
Total SAV		Point generated by BMCS		Will totalize all SAV's in a specific lab, zone, or area
Total HEV		Point generated by BMCS		Will totalize all HEV's in a specific lab, zone, or area
Total GEV		Point generated by BMCS		Will totalize all GEV's in a specific lab, zone, or area
Excess (offset)		Point generated by BMCS		Will totalize all offset's from SAV's in a specific lab, zone, or area
Graphics should provide graphical representation of laboratory and data at bottom, approved by FM EMS Controls				

C. Sequence of Operation and Software

1. The EOR is shall provide sequence of operation to ensure all aspects of the design intent is met. Additional software and hardware points, in addition to what shown on drawings, may be required to meet the design intent.
2. All software sequences should be reviewed by UNLV FM BAS/EMS Controls department. A points list should be provided to determine alarm limits and points to establish alarms.
3. Software functions should be written in a manner to prevent equipment damage and seamlessly transition through all modes and conditions.

SECTION 16010

ELECTRICAL GENERAL DESIGN REQUIREMENTS

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SUMMARY

This section contains general information for Electrical Design.

GENERAL DESIGN AND PERFORMANCE REQUIREMENTS

The most current editions of the following codes, regulations, and standards shall be used in electrical systems designs:
- National Electric Code
- National Electric Safety Code
- National Fire Codes (NFPA Standards)
- Uniform Building Code
- Uniform Fire Code
- Model Energy Code
- Lighting Handbook published by the Illuminating Engineering Society (IES)
- IEEE Recommended Practice Color Book Series published by the Institute of Electrical and Electronics Engineers
- Commercial Building Telecommunications Wiring Standard, EIA/TIA 568, published by the Electronic Industry Association and the Telecommunications Industries Association.
- Commercial Building Standard for Telecommunications Pathways and Spaces, EIA/TIA 569, published by the Electronic Industry Association and the Telecommunications Industries Association.
- Nevada State Fire Marshal’s Regulations
- Americans with Disabilities Act
- Local codes and ordinances as may be applicable

All electrical equipment and equipment rooms shall be designed to ensure adequate provisions for service, maintenance, and removal/replacement of electrical equipment, panels, switchboards, transformers, generators, etc.

All electrical equipment, light fixtures, etc. shall be securely anchored to resist earthquake loads.
Sinks: When receptacles are installed within 1.8 m (6 ft.) of the outside edge of any sink, this includes laboratory sinks, they shall be GFCI protected.

Electrical calculations are required for all aspects of the electrical systems. Calculations shall be neatly prepared and organized so that an independent peer reviewer can readily check the validity and completeness of the analysis and design. All significant electrical components shall be validated by calculations. Computer programs used shall be identified by name and version number and the input results shall be clearly documented and presented.

The minimum calculations required for each project are:
- Energy code Compliance calculations
- Lighting calculations for all spaces (interior and exterior)
- Feeder voltage drop calculations
- Short circuit calculations
- Service load calculations (Per NEC)

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Technical Design Guidelines
- Refer to specific technical sections in this guide for more specific requirements.

Energy Conservation
- The electrical design shall take all steps economically feasible to insure the lowest energy consumption possible.
- Lighting design shall exceed the requirements of IECC by 20% by utilizing energy efficient lamp and ballast combinations. Incandescent sources will not be used.
- Buildings larger than 20,000 square feet in area shall utilize 480/277 volt three phase distribution systems. Smaller buildings shall be either 208/120 volt single or three phase.

Electrical Service
- Each building shall have its own service transformer.
- Metering of each service shall be provided at each main switchboard. Meter shall measure voltage and amperage for all phases, KW, KVA, power factor, accumulated KWH, peak KW demand for a 15 minute period and harmonic/power quality. Additionally sub-metering will be provided at motor control centers or distribution boards serving motors/HVAC equipment. Metering requirements are addressed by specification section 16290.

Electrical Equipment
- Electrical distribution equipment-switchboards, distribution boards, panel boards and dry-type transformers shall be located in interior rooms dedicated as electrical rooms. Exceptions would be areas that have significant electrical load requirements such as mechanical rooms, laboratories, data centers, kitchens and the like.
- The main service entrance main disconnecting means must be provided with a shunt trip operated from the main electrical room exterior.
- All electrical distribution boards, motor control centers, panel boards shall have a minimum of 10% spare positions but as a minimum 6 poles.
- Where a branch circuit panel is installed flush in a wall, provide one ¾" conduit per every three pole spare, stubbed into accessible ceiling space.
- All equipment must be permanently labeled. Branch circuit directories must be typewritten and each circuit connected must have a complete description of the load served.
- Dry type transformers shall be Energy Star compliant. Coordinate heat generation requirements with the project mechanical engineer. Transformer coil shall be copper.
- Provide means for harmonic suppression for equipment that are likely to have significant harmonic content.
- All equipment buses shall be copper.

Conduit/Raceways
- All conductors are to be enclosed by conduit or other suitable means, i.e., totally enclosed cable trays, surface raceways.
- Flexible conduit in lengths exceeding six feet in length are not to be used. This includes AC or MC type cables.
- The minimum size conduit installed below grade shall be 3/4" otherwise the minimum above grade conduit size is to 1/2".
- Fittings electrical metallic tubing (EMT) shall be steel, watertight, gland-ring type or steel set screw type.
- PVC conduit shall be used only below grade.
- Conduit transition from below grade to above grade shall be accomplished with PVC coated GRC elbows (or 2 lap wrapped with approved tape to achieve a minimum 20 mil. thickness over standard GRC elbows).
- Conduits located in concrete slabs shall not exceed ¾" in diameter and be spaced no closer than 8" on center except in junction/pull boxes.
- Conduit installed overhead or in ceiling plenum spaces shall be independently supported and routed parallel or perpendicular to the building lines.

- Conduit routed within walls shall be supported and secured with properly manufactured devices. Ferrous metal wire shall not be used.
- For systems above 50 volts provide an accessible pull box after every 270 degrees of bend. For tele/data systems, provide pull box after every 180 degrees of bend.

Conductors
- All conductors shall be copper.
- Minimum power and light conductor #12AWG.
- Insulation shall be properly rated for system voltage and conditions.
- Do not exceed minimum bending radius for conductors.
- Conductors to variable frequency drives (VFD) shall be routed through the disconnecting means before being routed to the VFD.

Lighting
- Special use areas or areas used for multiple purposes which may require unusual levels of illumination shall be reviewed with UNLV and approved during the early stages of design.
- Exterior doors and entries shall have illumination on the outside.
- Fluorescent fixtures shall be specified with high frequency electronic ballasts having a total harmonic distortion of 20% or less and a power factor of 90% or greater.
- Lighting controls shall be provided for all building spaces except for small spaces served by a single two-lamp fluorescent fixture. Lighting shall be controlled by motion sensors, multi-level switching, or daylight dimming, as appropriate.
- In-ground exterior light fixtures shall not be specified.

Grounding
- Proper grounding shall be provided for all electrical systems. Requirements for bonding connections at service entrances, metal piping, structures, panel boards, and transformers shall be clearly noted on the appropriate drawings.
- All circuit grounds shall be made up such that a continuous path is reliably maintained to a grounding electrode or system. The ground field (ufer, grids, plates, etc.) shall have a maximum resistance of 5 ohms.
- Special consideration shall be given to grounding of sensitive office equipment (computer, servers, data circuits, etc.).

Telephone and Data Systems
- In all new buildings, and where required as part of the project scope of work, the design shall provide for communications pathways and spaces for the elements of the communications systems including, but not limited to, multi-service communication systems, twisted-pair systems, coaxial cable systems, and optical fiber systems.
- Data equipment rooms shall be located on each floor and all data drops shall be less than 300 feet from face plate to the point of termination. Distances shall be measured along the actual cable path including service loops.
- Coordinate the extent and layout of conduits, raceways, conductors, and cables with the Using Agency and allow for significant but reasonable changes in use of the spaces served.
- Wherever multiple data/voice connections are specified at a single location each data/voice connection type shall be a different color (generally blue for data and white for voice).

Fire Alarm Systems
- New buildings shall be equipped with a fire alarm system when required by the International Building Code. When a fire alarm system is required, the system shall be designed in conformance with the requirements of the
- International Building Code and the International Fire Code.
- All initiating and indicating devices shall be specified to be tested for both “alarm” and “trouble” conditions in a test conducted by the installing contractor and witnessed by the appropriate fire authority and by UNLV’s designated representative.

Generator

- When a standby generator is required due to elevator or other mechanical loads, an exterior mounted-weatherproof generator set will be provided. If generator will also serve exit and egress lighting, diesel shall be the fuel choice.
- Emergency generators shall be specified for a combined mechanical and electrical efficiency of 80% or greater.
- Emergency generators shall be specified with the capability for recovery to 90% of the rated voltage and 90% of the rated frequency within 1 second (60 cycles).
- Provide integral 50% resistive load bank.

QUALITY CONTROL TESTING

Specifications shall include testing requirements (including documentation of test results) as are appropriate for the electrical systems utilized in the project. Testing and testing documentation requirements shall be in accordance with a recognized testing standard (such as those published by the International Electrical Testing Association, the Institute of Electrical and Electronics Engineers, or the James Biddle Company).

SECTION 16020

METERING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for Electrical Metering of Buildings.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Measurements
Meters shall measure voltage and amperage of all phases, KW, KVA, Power Factor, accumulated KWH, peak KW demand for a 15 minute demand period, and harmonics/power quality as necessary.

Locations
Meters shall be installed on each main service of a building. Sub-meters shall be installed on the motor control centers serving major HVAC equipment and other major services.

Communications
Provide and install all communications and network devices necessary to fully communicate with the existing campus metering network provided by SquareD/Powerlogic or equivalent Communications are via the Campus LAN to the SquareD/Powerlogic software on the server in the Campus Services Building On multiple meter installations, on meter shall act as the master connection to the Campus LAN and all other meters shall be chained to the master. Since the system is Internet TCP/IP protocol based, static TCP/IP addresses shall be obtained from the UNLV IT Department through the UNLV Office of Planning and Construction. If no Internet connection is available, the project shall provide all work and equipment required to connect the building to the central Campus Metering computer station located in the Campus Services Building.
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Software
All systems must be fully compatible with the SquareD/Powerlogic networked system. All interfaces and protocols must be transparent to the user/owner. Any software modifications or adds must be approved by UNLNV and will be installed and fully tested and operational.

Meter Selection
Meters shall be selected using SquareD/Powerlogic or equivalent with the following schedule: 1000 to 6000 amps use Square D CM3350 or equivalent. 300 to 1000 amps use Square D PM850 or equivalent. Less than 300 amps use Square D PM710 or equivalent. All meters must be compatible with and communicate with the UNLV MODBUS system which is the SquareD/Powerlogic System Manager Software Final meter selection shall be approved by UNLV.

SECTION 16060

GROUNDING AND BONDING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for the grounding of building services and separately-derived systems under 600 volts. "Building service" can refer to utility services or services originating in other UNLV buildings. This section also contains design criteria for grounding and bonding electrical equipment.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Ground all equipment with insulated ground wires run in conduit with circuit conductors. Construct metal raceway systems to create an independent and redundant ground path bonded to the ground wire at all boxes and enclosures. Provide another redundant ground where nonmetallic conduits are used (for example, use ground loop).

For all circuits of systems over 50 volts to ground, include an insulated equipment grounding wire sized per NEC requirements. In addition, design metal raceway systems to serve as a redundant grounding conductor, and bond the insulated grounding wire to the metal raceway system at all terminations.

Where isolated grounding systems are provided, provide an additional insulated grounding wire to serve isolated ground terminals.

Grounding System Resistance shall be Five Ohm or less:

- All medium voltage duct banks shall contain a minimum #2/0 bare stranded copper conductor, connect this conductor to other grounding conductors and/or grounding electrodes.
- Every feeder and branch circuit raceway shall contain an equipment grounding conductor.
- Proper grounding shall be provided for all electrical systems, noting bonding connections at services entrances, metal piping, structures, panel boards, transformers, etc.
- All circuit grounds shall be made up such that a continuous path is reliably maintained to a grounding electrode or system.
- Special consideration shall be given to grounding of sensitive office equipment (computer data circuits, etc.)
- Provide code acceptable isolated grounding for computer and communications room.
- Utilize ground busses for termination of grounding conductors.
- Configure emergency generator systems as separately derived systems.
- Cable or electrode connections shall be exothermic.
- Provide all building services with a minimum of two grounding electrodes described by the NEC and bonded together to form a grounding electrode system.
- Ensure that all grounding electrode system bonding conductors are the same size and type as the grounding electrode conductor from the system neutral connection and are run within conduit.
- Effectively ground metal building frames by using connections to concrete-encased electrodes within the foundation, a ground ring encircling the building.
- Provide concrete-encased electrodes and ground rings for all new buildings.
- Do not bond neutral conductors to grounding conductors at locations other than those specifically allowed by the NEC. Connect generators to wiring systems by
- transfer switches employing solid neutrals. Do not bond grounding conductors to neutral conductors

at generators.

Where a special grounding system (for example, an isolated ground or ground grid) is provided for sensitive electronic equipment, bond the grounding system to the equipment grounding conductor only at the grounding system's point of connection to the system neutral conductor. Special grounding systems that are completely isolated from the building's normal equipment grounding system are never acceptable. Where shielded isolation transformers are provided, bond the electrostatic shield to the primary circuit equipment grounding conductor.

On construction drawings, indicate all required methods of service grounding and separately derived system grounding by specific details or notes. References to NEC requirements without such details or notes is not acceptable.

PRODUCT STANDARDS

Ensure that all products conform to the requirements contained in UL 467, Electrical Grounding and Bonding Equipment.

MANUFACTURERS

Any products that meet the materials requirements are acceptable.

MATERIALS

Use copper-clad steel ground rods with a minimum diameter of 3/4 inches and a minimum length of 10 feet. Where longer rods are required, use 1-inch diameter sectional rods.

For grounding conductors, use green insulated building wire.

Connectors used for grounding must meet the following requirements:
- Mechanical connectors shall be cast bronze. Connectors used in branch circuits with # 14 to #10 AWG solid conductors may be spring wire connectors with a green plastic shell, designed for grounding.
- Compression connectors must be copper.
- Welded connections must be exothermic-type and copper.

INSTALLATION GUIDELINES

Where ground grids are required under raised floors, specify #2 AWG bare copper conductors in each direction on 24-inch centers with cross-type compression connectors where grid conductors cross. Bond each item of equipment in room individually to the grid and to the isolated grounding conductor. Bond the grid directly to the isolated grounding conductor. Where necessary, bond the grid to each floor pedestal.

For buildings with metal siding that does not have an electrical connection to a metal building structure, bond the siding to equipment grounding conductors in panelboards at a minimum two, diametrically opposite locations.

Provide ground busses in all access holes and vaults containing circuits operating over 600 volts.

Specify new insulated or isolated ground bar for ail panelboards through which isolated grounding conductors are run.

Do not bond isolated grounding conductors to equipment grounding conductors at locations other than at the point where system neutral is bonded to grounding electrodes. In small projects where new wiring does not extend beyond a local panelboard, insulated or isolated ground bar may be bonded to equipment ground bar in the panelboard.

At isolated grounding receptacles, bond the equipment grounding conductor to the box.

Preparation
Where new feeders terminate in existing switchboards that do not contain grounding busses, specify new copper grounding busses sized at 20 percent of the phase busses, located at the bottom of the enclosures, and extending the full width of the enclosures.

Where new circuits terminate in existing panelboards and the ground bar is full or does not exist, specify a new ground bar.

QUALITY CONTROL

Test the resistance to ground of all grounding electrodes under any of the following conditions, and submit the test results to UNLV:

- Where new low voltage building services arc installed.
- Where existing low voltage building services are upgraded.
- Where new or replacement grounding electrodes are installed or newly connected.

SECTION 16075

ELECTRICAL IDENTIFICATION

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for electrical and wiring identification systems.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Ensure that identification systems are compatible with existing systems, provide for future additions to system, and are consistent throughout the project.

On construction documents, indicate identification systems and designations for all equipment and wiring.

On identifying plates, indicate unit designation or load served, as applicable, and other information not clear, which might be required by service personnel, particularly about emergency conditions.

Ensure that color-coding for power and lighting circuits is in accordance with Section 16120: Wire and Cables.

For systems, such as fire alarm, intrusion detection, access control, intercom, public address, television, and audio/visual, ensure that the color-coding of wiring is in accordance with UNLV and industry or manufacturers' standards. In instances where these standards conflict, UNLV standards take precedence, UNLV Telecommunications.

In accordance with Section 16442: Panelboards, follow a specific methodology for panelboard designations. Show the designation on every panel schedule on the panel door and in the construction document.

Manufacturers
Any product that meets the materials requirements is acceptable.

MATERIALS

For equipment identification plates, use:
- Laminated phenolic resin
- Black with a white core (unless specific design conditions require an alternate color scheme)

Engraved lettering
For branch circuit wiring and circuit cable identification markers for systems such as fire alarm and intrusion detection, use:
- Pre-printed plastic
- Black-on-white background
- Pressure-sensitive adhesive

INSTALLATION GUIDELINES

- Provide all equipment, including switchboards, panelboards, transformers, safety switches, and motor controllers with identification plates secured with stainless steel screws.

- Neatly type directories for equipment controlling multiple circuits (panelboards, fire alarm control panels, intrusion detection control panels), and mount them on the inside of the panel front cover. Ensure that circuit numbers marked in the field match the circuit numbering contained in the construction documents, so that future references to system wiring can be obtained easily.
- Identify branch circuit numbering at the panelboard. Identify wiring for other systems, such as fire alarm and intrusion detection, at all terminations and connections.
- When required by individual standards, such as fire alarm systems and energy management and control systems standards, paint conduit and boxes to identify the system contained within. Painting is described in Division 9, Finishes standards.

SECTION 16120

WIRES AND CABLES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains criteria for Wires and Cables.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Medium Voltage Cable
Insulated cable for use above 600 Volts shall have copper conductor with a copper tape shield.

Medium Voltage Splices
Splices made on cable used over 600 volts shall be heat shrink type with appropriate shield ground kits. Splices points with more than two cables shall be made with a manufactured product. Taped splices and “T” taps shall be used only on existing equipment with written permission from UNLV Office of Planning and Construction.

Medium Voltage Terminations
Cable used above 600 Volts shall use elbow type terminations, where possible. If existing equipment does not have provisions for elbow type terminations, heat shrink termination kits shall be used. Taped terminations can be used only with written permission from UNLV Office of Planning and Construction.

Medium Voltage Spares
UNLV Facilities Maintenance shall be provided with a spare set of three of each type and size splice or termination kit used.

Slack Cable
Sufficient cable slack shall be allowed in manholes with spliced cables and at termination equipment to allow for replacing the splice or termination.

Low Voltage Cable
All wire and cable for use below 600 Volts shall have copper conductor.

Materials
- Conductor material shall be copper.
- No wire smaller than #12 AWG shall be used for light and power circuits.
- Conductors shall be solid for #10 AWG and smaller and stranded for #8 or larger.
- Instrument cable shall consist of twisted shielded pair or triads.

Color code cables as follows:

Phase	120/240 Volts	120/208 Volts	277/480 Volts	Isolated Ground
A	Black	Black	Brown	Contrast Stripe
B	Red	Red	Orange	Contrast Stripe
C	Orange	Red	Orange	Contrast Stripe
Neutral	White	White	Gray	Contrast Stripe

Equip. Ground	Green	Green	Green	Contrast Stripe

Type MC cable shall not be used.

SECTION 16130

RACEWAY AND BOXES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for conduit, metal raceways, multi-outlet assemblies, and various box systems for general electrical construction.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

All building interior power, telephone, signal and other low voltage wiring (whether plenum rated or not) shall be installed in raceways, except for low voltage wiring in a remodel where other methods are currently being utilized.

Cable Trays
Open top ladder cable trays shall be installed. History shows that covers are traditionally left off covered trays, thus rendering the fire rating of the covered tray useless. Cable trays shall be installed with a minimum clearance of two (2) feet above the cable tray for installation, future addition, and maintenance access. Access space for a ladder shall be provided to the side and below the cable tray. The Architect shall ensure that the design includes provisions and methods to prevent obstructions from entering this access space. Project specifications shall include a statement to the effect that if obstructions are found, they will be corrected at Contractor's expense. If this statement is omitted from the project, obstructions will be corrected at the Architect's expense.

Conduit
Conduit shall be secured and supported as required by the NEC. Conduit runs shall be installed level and plumb. Non compliance with these requirements shall be corrected at the Contractor's expense.

Cover Over Medium Voltage Conduit
Underground conduit for all medium and high voltage circuits over 35 kV shall be encased in red concrete. Work shall be in accordance with Nevada Power Standards for those installations where Nevada Power Standards require red concrete.

Flexible Conduit
Flexible conduit shall only be used for lighting whips. Any run of flexible conduit longer than 6 feet is unacceptable. All flexible conduits shall be steel. Aluminum flexible conduit is unacceptable.

Manhole Locations
Underground manholes and pull boxes shall not be located in turf areas. Manholes and pull boxes shall not be located at the lowest point of grade. Manholes and pullboxes shall not be located in a drainage path.
Site grading shall slope away from all sides of underground manhole and pull box locations. All manholes and pull boxes located in a landscape area shall be raised 8 inches above finished grade.

Vibration Isolation
Liquid tight conduit shall be used to isolate equipment from isolation. Normal flexible conduit shall not be used in this application.

Design metal conduit systems to maintain a continuous grounding path redundant to the grounding path provided by insulated grounding conductors.

Where necessary, field-paint conduit or raceway systems to match the color of existing surfaces upon which they are installed.

Provide dedicated conduit systems for the following:
- Alternate service circuits
- emergency circuits
- Fire alarm systems
- Intrusion detection systems
- Access control systems
- Telecommunications systems
- Public address systems
- Audio/visual systems
- Where wiring for environmental controls (including EMS and isolated HVAC systems) must be run within conduits, provide a dedicated conduit system. This is mandatory.

Ensure that conduit or raceway routings shown on construction drawings follow actual proposed routings as closely as possible.

Give priority over conduit or raceway runs to runs of ductwork and piping that pitch or have similar elevation or location requirements.

As much as possible, conceal conduit that runs through finished areas. Design conduit routings that enable conduit to be fished through existing hollow walls and ceilings and routed through adjacent unfinished areas, such as basements, storage rooms, mechanical rooms, closets, and attics.

Spray-on fireproofing

Do not run exposed conduit on exterior walls.

Minimum conduit sizes:

Conduit sizes must meet the minimum sizes permitted by NEC calculations.

The minimum conduit size above grade must be 1/2 inches.

The minimum conduit size below grade is two inches, unless noted otherwise in the specification.

The minimum conduit size in the electrical duct bank for 12.47 kV and 4.16 kV systems is four inches (4”). The duct bank must have concrete encasement with #4 rebar reinforcement at both ends. The rebar reinforcement is required if the duct bank is installed under a roadway. The top of the duct bank must be dyed red with warning tap and covered with metal. The last ten feet of duct bank before it enters the building must be rigid conduit through coupling. All 90 degree bends must also be rigid conduit.

Use surface raceways only in finished areas where conduits cannot be concealed in existing construction.

If unavoidable, design surface raceway routings to blend in with existing architectural elements. Where possible, locate equipment in areas that will keep raceway runs unobtrusive.

Size boxes in accordance with NEC requirements for maximum capacity of the largest conduit entering the box, unless restricted by available installation space.

Locate boxes in finished areas above accessible ceilings. Where boxes are installed above inaccessible ceilings, locate them within six inches of the access panel.

Enclosures or boxes must be suitable for the locations in which they are installed.

Dry locations: NEMA 1 (general purpose).

Damp and wet locations: NEMA 3R (rain-tight).

Swimming pools and certain laboratories where corrosive fumes may be present: NEMA 4X (corrosion-resistant watertight and dust-tight).

Areas where gases and vapors create explosion hazards: NEMA 7 (Class I hazardous locations - air-break equipment).

Areas where combustible dust creates explosion hazards: NEMA 9 (Class II hazardous locations - air-break equipment).

Carpentry shops, machine shops, and similar locations: NEMA 12 (dust-tight and drip-tight) or NEMA 13 (oil-tight and dust-tight), as applicable.

Fittings for electrical metallic tubing shall be steel, watertight, gland-ring types or steel setscrew types.

All metal conduit, couplings, elbows, and fittings buried below grade shall be coated with PVC or 1/2-lap ' wrapped with an approved tape (coating or wrapping shall be a 20 mil total thickness). In lieu of rigid galvanized conduit for horizontal secondary service raceways and branch circuit wiring in or under a floor slab, Schedule 40 PVC may be used with rigid steel conduit termination stub-ups out of the ground or slab and into the building.

PRODUCT STANDARDS

Ensure that all products conform to the following standards:

- NEMA RNI, Polyvinyl-ChlorideExternally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing
- NEMA TC2, Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80)
- NEMA TC3, PVC Fittings for Use with Rigid PVC Conduit and Tubing
- UL 1, Flexible Metal Electrical Conduit
- UL 6, Rigid Metal Electrical Conduit
- UL 360, Liquid-Tight Flexible Steel Conduit, Electrical
- UL 514B, Fittings for Conduit and Outlet Boxes
- UL 651, Schedule 40 and 80 Rigid PVC Conduit
- UL 651 A, Type EB and A Rigid PVC Conduit and 11DPE Conduit
- UL 797, Electrical Metallic Tubing
- UL 886, Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
- UL 1242, Intermediate Metal Conduit
- UL 5, Surface Metal Electrical Raceways and Fittings
- UL 498, Electrical Attachment Plugs and Receptacles
- UL 50, Electrical Cabinets and Boxes
- NEMA OS1, Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
- UL 514A, Metallic Outlet Boxes, Electrical
- UL 870, Electrical Wireways, Auxiliary Gutters, and Associated Fittings

Manufacturers
Acceptable surface raceway systems manufacturers include:
- Walker Wiremold
- Any other products that meet the materials requirements are acceptable.

MATERIALS

Rigid metal conduit (RMC), intermediate metal conduit (IMC), electrical metallic tubing (EMT), and flexible metal conduit (FMC) must be galvanized steel, unless specific design conditions require alternate material.

Liquid-tight flexible metal conduit (LFMC) must be of interlocked steel construction with a PVC jacket. Specify conduit up to I-1/4 inch trade size with an integral continuous grounding conductor.

Rigid nonmetallic conduit (RNMC) must be self-extinguishing, schedule 40 PVC, unless noted otherwise.

Fittings and supports must be compatible with conduit material. Die-cast zinc fittings are not acceptable.

Bushings must be of a metallic, insulating type, consisting of an insulating insert molded or locked onto the metallic body of the fitting.

Insulating material must be nylon or thermosetting phenolic. Bushings made entirely of metal or nonmetallic material are not permitted.
However, metallic bushings may be used where EMT is terminated without entering a box (such as at telephone backboards).

Bushings on I -1 /4 inch trade size and larger conduits must be grounding-type.

Set screw fillings are acceptable only on EMT systems. Do not use split, clamp-typc, threadless fittings unless required by specific design conditions.

Conduits located in concrete slabs shall not exceed 3/4" and shall be spaced no closer than eight inches on center except at panel and junction boxes where they shall be spread as widely as possible. Provide for special framing when required where conduits enter a panel board. In cases where conduits larger than 3/4" are to be placed in a concrete slab, the structural engineer shall be notified/consulted.

Use flexible steel conduits in the following applications and install a code sized ground wire. 3-foot maximum length on flexible conduit except as authorized by University's representative:
- recessed lighting fixtures
- motor connections
- connection between fan plenum and structure
- at expansion joints
- at transformers and other equipment that produces vibration
- at damp and wet locations or where exposed to weather, flexible steel conduit shall be liquid tight type. MC cable shall not be used; except for a maximum of six feet at ceiling lighting fixtures.

All surface raceways must be steel, with a baked enamel finish, or aluminum. Nonmetallic raceways are not acceptable.

Outlet and device boxes installed in dry locations must be galvanized steel with knockouts. Outlet and device boxes installed in damp or wet locations must be cast malleable iron.

Floor boxes must be fully adjustable, cast malleable iron for concrete floors and galvanized steel for wood floors.

Pull and junction boxes installed in dry locations must be sheet steel with an enamel finish. Pull and junction boxes installed in damp or wet locations must be cast aluminum with threaded hubs.

Wireways must be general-purpose, lay-in type, sheet steel with an enamel finish, and must include knockouts, fittings, and adapters, as necessary for a complete system.

Box covers must be suitable for use with boxes. Specify gaskets in damp and wet locations.

NEMA 1 cabinets and enclosures must be sheet steel with an enamel finish. Where cabinets and enclosures are provided for housing controls, such as pushbuttons, pilot lights, and relays, covers must be mounted with a continuous hinge and close with a key-operated flush- or lever-type latch. Covers must also be equipped with an interior steel pocket for the storage of drawings and instructions. Provide an interior panel for mounting items such as terminal blocks, relays, and similar equipment. Provide accessory feet for free-standing units.

NEMA 3R enclosures must be sheet steel with an enamel finish.

NEMA 4X enclosures must be fiberglass-reinforced polyester.

NEMA 7 and 9 enclosures must be cast aluminum. Covers must be of a threaded type or employ an alternate method to open and close quickly and easily. Covers with numerous bolts are not acceptable. Specify breathers and drains when enclosures are mounted in damp or wet locations.

NEMA 12 enclosures must be sheet steel with an enamel finish. Enclosures with knockouts are not acceptable.

Installation Guidelines

- Unless otherwise noted, exposed raceways in finished interior locations must be surface metal raceway.
- Specify EMT in all concealed or unfinished interior locations, with the following exceptions:
- Specify FMC in dry locations to fish through inaccessible spaces (for example, within hollow walls or above hung ceilings not constructed of removable tiles or panels).
- Specify FMC to connect to movable equipment, equipment installed in hung ceilings, or bus duct plugs in dry locations. Lengths of such flexible conduits must accommodate all anticipated ranges of movement. Lighting connections cannot exceed six feet.
- Specify LFMC to connect to vibrating equipment or equipment where sound isolation is required, including 25 KVA and larger transformers in dry locations.
- Specify LFMC for the installation conditions described in paragraphs a, b, and c that occur in damp or wet locations, or where subject to contact with coolants, oils, corrosives, or other similar substances.
- Specify RMC or IMC for all other installation conditions in damp or wet locations.
- Specify LFMC under raised floors.
- Specify RMC in hazardous locations. Where flexible connections are required in hazardous locations, specify fittings listed for such use.
- In corrosive locations, specify rigid non-metallic conduit. Where conduit is also subject to physical damage, specify plastic-coated RMC. In such locations, conduit fittings must also have plastic coatings.
- Specify RMC where conduit is subject to physical damage.
- Specify RMC where conduit is provided for systems operating above 600 volts.

Conduits installed within interior concrete slabs or below grade within building walls are considered to be installed in exterior locations.

Specify RMC in all exterior locations, with the following exceptions:

- Conduits installed underground must be PVC or HDPE, schedule 80. Where such conduits are encased by two inches or more of concrete, PVC or HDPE, schedule 40 may be specified. The minimum earth cover must be 30 inches. Underground conduits serving circuits over 600 volts must be concrete-encased.
- Concrete-encased conduits within buildings must be HDPE or PVC, schedule 40.
- Conduits installed on rooftops must be sunlight-resistant PVC, schedule 80.
- Where empty conduits are to be run, specify a pull wire with identification tags at each end, indicating the purpose of the conduit and the location of other end.
- Plug the end of the conduit with the pull wire in place.
- Where conduits are to be run underneath metal roof decking, specify spacers that provide a minimum one-inch gap between the conduit and the roof deck to
- avoid penetration of the conduit by roofing fasteners.
- Maintain a conduit clearance of at least six inches from hot water, steam, and other high-temperature lines. Maintain a clearance of at least six inches between power conduits and instrument or communication conduits.
- Specify that surface metal raceways be painted in accordance with the requirements of Division 9, Finishes to match adjoining finishes.
- Conduit bodies may be substituted for conductor pull boxes up to #2 AWG, except in telecommunications systems. Given sufficient conduit quantities and wire fill, outlet boxes 4 inches square by l -1/2 inches deep or larger may be substituted for pull and junction boxes in runs of 1/2-inch and 3/4-inch conduit
- The minimum depth of outlet and device boxes is 2-1/2 inches, except for boxes containing only splices, which may be 1-1/2 inches deep. The minimum depth of pull and junction boxes is twice the trade size of the largest conduit entering the box.
- The installation of back-to-back recessed boxes in walls or partitions is not permitted.

SECTION 16140

WIRING DEVICES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for receptacles, wall switches, and cover plates; as well as miscellaneous items, such as dimmers, small fan speed controls, interval timers, time switches, occupancy sensors, photocontrols and call-for-aid devices.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Cover Plates
- Cover plates for convenience outlets located in classrooms, hallways, and lobbies shall be stainless steel.

Split-face Block
- On split block walls, the Architect/Engineer shall coordinate with Division 4 to provide a smooth block at all electrical, fire alarm, communications, and control device locations. If a smooth block is not provided, the device shall have a stainless steel cover plate.

Weatherproof Outlets
- Weatherproof convenience outlets shall have covers that maintain their weatherproof rating while the outlet is in use. The exception to this is if the outlet is located where the cover would be subject to damage. In this case, a standard weather proof cover may be used.
- Confirm all receptacle configurations with the equipment plug to be connected. Use only standard NEMA configurations.
- All receptacles must be grounding-type, including locking types, three-phase, and special configurations. Where areas of renovation projects contain ungrounded receptacles, remove and replace them with grounding-types receptacles. Replace the plugs and cords on associated equipment, and add grounding conductors to branch circuits to provide a continuous grounding path.
- Use ground-fault receptacles in preference to ground-fault breakers located in panelboards.
- Specify occupancy sensors with off delay for the control of exhaust fans in toilet rooms.
- Use time switches only for mechanical loads. Use occupancy sensors and photocontrols for automatic control of lighting loads.
- Outlet boxes, covers, rings and other fittings shall be galvanized steel.
- Gang type plates shall be used for multiple gang boxes.
- Locate occupancy sensors on walls. Where necessary, provide ceiling sensors to supplement wall sensors. Should be located above doors.
- Locate photocontrols in areas where their operation will not be affected by lighting from buildings, vehicles, or other artificial sources.
- It is the engineer's responsibility to provide and tag life safety dedicated circuits, such as the circuits for the fire alarm and direct digital controller. Incorporate locking devices for circuit breakers providing power to these circuits.

SUBMITTALS

Furnish occupancy sensors with a minimum three-year manufacturer's warranty.

PRODUCT STANDARDS

Ensure that products conform to the following standards:
- NEM A WD1, General-Purpose Wiring Devices
- NEMA WD2, Semiconductor Dimmers for Incandescent Lamps
- NEMA WD5, Specific-Purpose Wiring Devices
- UL 20, General-Use Snap Switches
- UL 498, Electrical Attachment Plugs and Receptacles
- UL 508, Electric Industrial Control Equipment
- UL 773A, Non-Industrial Photoelectric Switches for Lighting Control
- UL 943, Ground-Fault Circuit Interrupters
- UL 1449, Transient Voltage Surge Suppressors

Manufacturers
All manufacturers need to be verified with facilities.
Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:
- Wiring Devices
- Fan Speed Controls
- Dimmers

Approved Manufacturers:
- Bryant
- General Electric
- Hubbell
- Leviton
- Lutron (dimmers only)
- Pass & Seymour
- Occupancy Sensors
- Leviton
- Hubbell
- Sensor Switch
- Switchomatic
- VEC
- Interval timers, Time Switches, and Photocontrols
- Paragon
- M.H. Rhodes
- Tork
- Zenith
- Call-for-Aid Devices
- DuKane
- Edwards
- Florence

MATERIALS

- Use specification-grade, side-wired receptacles only, with nylon or thermoplastic faces, and colored ivory in finished areas, unless other colors are more appropriate for adjacent wall finishes. Receptacles must be rated for a minimum of 20 amperes, except where 15-ampere locking receptacles are required to suit particular equipment.
- Use duplex receptacles that feature break-off tabs for split wiring.

- Use feed-through type ground-fault receptacles for downstream fault protection. For ground- fault protection for personnel, use Class A-rated ground-fault circuit interrupters with test and reset buttons.
- Use isolated ground receptacles that feature an orange face and marking on the front to indicate an isolated grounding system.
- Use feed-through type surge suppression receptacles for downstream protection that contain visual and audible means to indicate when the device no longer provides specified protection. Surge suppressors must protect against normal- and common-mode surges, with a clamping level maximum of 500 volts upon a 120 volts basis per UL permanently-wired test, a minimum peak energy rating of 140 joules, and a response time of five nanoseconds or less.
- Specify receptacles connected to emergency circuits with a distinctive face color to distinguish emergency circuits from normal circuits. In existing buildings, color codes must match existing systems. Color codes in new buildings are determined by the UNLV Project Manager.
- Use only specification-grade, side-wired switches, with grounding terminals where available and ivory toggles in finished areas, unless other colors are more appropriate for adjacent wall finishes.
- Use full-capacity, 20 ampere-rated snap switches with resistive, tungsten, fluorescent, and high intensity discharge lighting sources. Use 80 percent capacity snap switches with motor loads.
- Use ivory, slide-type dimming switches with a positive off position and separate rocker switch to allow on-off switching without disturbing the preset light level. Use solid-stale dimmers with circuitry to filter radio-frequency interference.
- Use incandescent dimmers rated for a minimum of 1000 watts.
- Use fluorescent dimmers that are suitable for use with 32 watt, T8 rapid-start lamps (minimum 6 lamps, maximum 30) and are listed for use with electronic ballasts. Thyristor-type dimmers are not acceptable.
- Use single pole, double throw (center return), momentary contact switches.
- Use ivory, slide-type fan speed control switches for fractional horsepower motors with a positive off position and a separate rocker switch to allow on-off switching without disturbing preset speed levels. The control switches must be single-pole with a minimum 10-ampere rating. Use solid-state speed controls suitable for use with split-capacitor or shaded-pole motors with circuitry to filter radio-frequency interference.
- Use spring-wound, rotary electronic-type interval timer switches with a 30 minute range. The interval timer switches must be single-pole, single-throw, with a minimum 15-ampere rating at 120 volts.
- Use digital controller time switches with a capacitor backup requiring no battery. If the required configuration is not available with a capacitor backup, an alkaline battery backup may be specified. Time switches must be suitable for 120 volt control with minimum single-pole, double-throw dry contacts rated at 20 amperes inductive at 120/240 volts. Time switches must also contain an LCD display and must be capable of seven-day scheduling with automatic daylight savings time and leap year adjustments that include a minimum of 16 set points at one minute resolution and manual override capability to next scheduled event.
- Use passive, infrared-type occupancy sensing switches for lighting control. Sensing switches must be rated at a minimum of 600 watts and equipped with an Off-Automatic selector switch with manual override by special key only. The time delay must be field-adjustable from 1 to 20 minutes. Sensitivity must also be field-adjustable. The LED must indicate when motion is sensed. Sensor failure must result in a continuously-energized load. After a power failure, the sensor must energize the load instantly upon restoration of power. Sensors must be RF1 resistant and compatible with electronic ballasts.
- The minimum sensing pattern of wall-mounted sensors must be 160° in the horizontal plane and 40° in the vertical plane, except in cases where a narrower pattern is required to eliminate detection of unrelated motion.
- The minimum sensing pattern of ceiling-mounted sensors must be 360° around the vertical axis, except in cases where a narrower pattern is required to eliminate detection of unrelated motion.
- Sensors must be capable of sensing, at a distance of 20 feet, the motion of a 12-inch long object rotating around the central axis of the sensor (with one end of the object fixed on the central axis) at a rate of 90° per second through a 90° arc in a plane perpendicular to the central axis of the sensor.

- Use ASTM type 430, stainless steel cover plates for recessed boxes in finished areas and for boxes on surface metal raceway systems. Use nylon plates where colored cover plates are required. Use galvanized steel cover plates for surface boxes on exposed conduit systems.
- Covers for cast boxes must be cast of the same metal as (he box and equipped with a gasket.
- Covers for weatherproof receptacles in damp locations must be cast aluminum for horizontal mounting, with an individual, spring-loaded, gasketed cover for each boss of a duplex receptacle.
- Covers for weatherproof receptacles in wet locations must be polycarbonate for horizontal mounting, with a hinged cover enclosing sufficient space for attachment plugs and cords to be connected with the cover closed.

INSTALLATION GUIDELINES

The following list identifies the standard mounting heights of receptacles and switches from a finished floor to the center of the device:

- Receptacles (except as noted below): 18 inches.
- Receptacles above counters: minimum 4 inches above the counter surface to the center of the device.
- Switches: 48 inches.
- Wall switches near doors shall be mounted not more than 12 inches from the jamb of the latch side.
- Install receptacles in vertical the position with the grounding pole al the bottom of the receptacle face. Receptacles installed in two-piece surface metal raceway systems, or with weatherproof covers, may be installed horizontally. Install switches on the strike side of a door, approximately four inches from the trim, in a vertical position with the load de-energized when the toggle is down. Arrange three-way switches such that the load is de-energized when both toggles are in the same position.
- Switches should generally be located within sight of the controlled load.
- Whenever possible, install receptacles with protective functions, such as feed-through protection in ground-fault and surge suppressor receptacles, in locations where the protective function is evident from the location of the protected device.
- Wrap conductors a 3/4 turn around screw terminals. Back wiring is not acceptable.
- Install dedicated neutral conductors on the load side of dimmers and fan speed controls.
- Use bonding jumpers to connect branch circuit equipment grounding conductors to devices and boxes.
- Where switches are ganged on 277-voll systems, provide a barrier between each switch.
- In laboratories and health care facilities, install receptacle cover plates with adhesive markers identifying the circuit number.
- Where receptacles are connected to emergency circuits, install cover plates engraved with the legend, "EMERGENCY" unless the receptacle face is color-coded in accordance with the standard in use throughout the building. Where
- receptacles are connected to alternate system circuits, install cover plates engraved with the legend, "ALT. SYSTEM".
- All corridors on hallways shall have duplex receptacles spaced over 50 feet apart.

QUALITY CONTROL

Use a plug-in receptacle tester to verify proper receptacle wiring. Use an external, calibrated ground-fault simulator to test all receptacles protected by ground-fault circuit interrupters for proper orientation.

SECTION 16231

DIESEL GENERATOR SET

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for Diesel Generators.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Diesel Generator Sets:

- Diesel generator sets for critical buildings shall have a fuel storage system that will permit a 4 hour run time at full load before refueling occurs.
- Non critical units shall have minimum fuel storage to permit 4 hours run time before refueling occurs.
- Only diesel fuel is acceptable.
- The generator/engine/control panel shall be a package system by a specified manufacturer with a minimum of ten years documented experience.
- Generator sets shall have “One source responsibility”. Gen sets and components to be prototype tested, factory built and production tested.
- Generator sets below 750 kw shall meet or exceed Tier III emissions minimum.
- Generator supplier shall have factory authorized engine and generator service center within fifty miles.
- Generator set shall be rated for 2100’ altitude or higher.
- Generator set controls shall have pre alarms for fuel level, coolant level, coolant temp, oil pressure as well as safety shutdowns.
- Generator shall be equipped with controls to permit remote communication.
- Generator shall be equipped with PMG (permanent magnetic excitation).
- Engine shall be equipped with an electronic governor.
- Generator set shall be rated for 120º F. ambient temperature or higher.
- Generator/ engine cooling system shall be capable of dissipating 100% engine heat rejection @ 100% rated load at spec. temp and altitude.
- Generator set enclosure should be sound attenuated for 75 dbs or less.
- Generator set enclosure shall be rodent proof.
- Unit mounted or remote load bank @ 50% or greater of rated load.
- Generator set shall be equipped with external drains for coolant, oil and fuel.
- Generator set shall have isolation valves for engine heater.
- Engine cooling system shall be equipped with a coolant level sight glass.
- Engine heater, (s) shall have an adjustable thermostat (s).
- Battery charger shall be equipped with adjustable rate.
- Generator set shall be equipped with complete service and parts manuals.
- Programming and or monitoring software and connecting cables to be included as well as detailed training.
- Provide a non-drawn out molded case circuit breaker at the generator for generator protection.
- Generator shall be capable of 75% block load minimum.
- Installation shall include minimum four hour load bank testing on startup.
- Provide minimum FOUR hours on-site operator training.

Transfer Switches
Acceptable manufacturers:

- Asco
- Zenith
- Cummins
- Caterpillar

Transfer Switch shall include an in-phase monitor option, transfer inhibit capabilities, and remote monitoring capabilities.

Start Up, (Configuring):

- Generator site location considerations
- Access for large fuel truck and load bank trailer.
- Generator engine exhaust in relation to building air intakes.
- Landscaping: caution with deciduous trees in close proximity to generator enclosure (debris gets sucked into radiator).
- Drainage form nearby cooling towers.

Bird Habit Issues:

- The generator shall have 2/3 pitch windings.
- The package generator/engine set shall be mounted within a weather protective sound rated enclosure. Sound rating on the enclosure shall be 72-75 decibels.

SECTION 16290

METERING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for electrical metering.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Measurements

Meters shall measure voltage and amperage of all phases, KW, KVA, Power Factor, accumulated KWH, and peak KW demand for a 15 minute period, and harmonics/power quality as necessary.

Locations

Meters shall be installed on each main service of a building. Sub-meters shall be installed on the motor control center serving major HVAC equipment and other major services.

Communications

Provide and install all communications and network devices necessary to fully communicate with the existing campus metering network provided by Square D/Powerlogic or equivalent. Communications are via the Campus LAN to the Square D/Powerlogic software in the Campus Services Building. On multiple meter installations, one meter shall act as the master connection to the Campus LAN and all other meters shall be chained to the master. Since the system is Internet TCP/IP protocol based, static TCP/IP addresses shall be obtained from the UNLV IT Department through the UNLV Office of Planning and Construction. If no Internet connection is available, the project shall provide all work and equipment required to connect the building to the central Campus Meeting computer station located in the Campus Services Building.

Software
All systems must be fully compatible with the Square D/Powerlogic networked system. All interfaces and protocols must be transparent to the user/owner. Any software modifications or adds must be approved by UNLV and will be installed and fully tested and operational

Meter Selection
Meters shall be selected using Square D/Powerlogic or equivalent with the following schedule. 1000 to 6000 amps use Square D CM3550 or equivalent. 300 to 1000 amps use Square D PM850 or equivalent. Less than 300 amps use Square D PM710 or equivalent. All meters must be compatible with and communicate with the UNLV MODBUS system which is the Square D/Powerlogic System Manager Software, final meter selection shall be approved by UNLV.

SECTION 16410

POWER FACTOR CORRECTION

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section specifies power design requirements.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Requirements

The building shall maintain a power factor of not less than .90 at the point of metered load connection. Automatic power factor correction at the service or power factor correction at the load shall be evaluated for the best solution.

Restrictions

The KVAR of power factor correction capacitors shall not exceed 25% of the KVA of the transformer supplying the service.

Variable Frequency Drives

Power factor correction shall not be used on variable frequency drives or their motors.

Installation Guideline

Wiring for individual motor power factor capacitors shall be installed in conduit.

SECTION 16415

TRANSFER SWITCHES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for automatic transfer switches and manual bypass or isolation switches.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Select three-cycle, short circuit closing and withstand ratings of transfer switches, including bypass/isolation switches, in accordance with a short circuit analysis that takes into account all current sources and all impedances between the sources and the switch.

Transfer switches shall be rated to carry 100 percent of rated current continuously.

Transfer switches shall be supplied with a switched neutral pole. The switched neutral shall be overlapping so that UPS system maintains voltage continuity.

All sensing controls such undervoltage, overvoltage, under frequency, engine start, return to normal, etc. shall be adjustable.

Provide an exerciser clock to set the day/time/duration of the generator set exercise/test period.

Specify the automatic transfer sequence as follows:

- When the normal source voltage drops below 80 percent on any phase (after a time delay adjustable up to six seconds to allow for momentary dips), the engine starting contacts shall close to start the generator.
- After restoration of the normal source on all phases to 90 percent of rated voltage, a time delay adjustable up to 30 minutes shall delay re-transfer to allow stabilization of the normal source. If the alternate source should fail during this time delay period, the switch shall immediately return to then normal source.
- For switches controlling engine-generator sets, the engines shall be allowed to operate at no load for a fixed, five-minute period after re-transfer to the normal source.
- Specify an Automatic Transfer Switch (ATS) with an integral Bypass/Isolation Switch (BPS) where the transfer switch serves critical loads that cannot be interrupted at any time for testing and maintenance.
- The nameplale ampacity of switches must be a minimum of 140 percent of the connected load at nominal system voltage.

Equipment

The ATS must have three or four poles, with all poles mounted on a common shaft. The ATS must be double-throw, actuated by a single electrical operator, momentarily energized, and connected to the electrical operator with a simple over-center type linkage. The total transfer time must not exceed one-half second. The transfer switch must be capable of transferring successfully in either direction with 70 percent of rated voltage applied to the switch terminals.

The normal and emergency contacts must be positively interlocked mechanically and electrically to prevent simultaneously closure. The main contacts must be mechanically locked in both the norma) and emergency positions, without the use of hooks, latches, magnets or springs, and must be provided on all transfer switches. Interlocked, molded-case circuit breakers or contactors are not acceptable.

The ATS must be equipped with a safe manual operator, attached permanently to the motor operator and designed to prevent injury to operating personnel. The manual operator must provide the same contact-to-contact transfer speed as the electrical operator to prevent flashover from switching the main contacts slowly.

The BPS must provide a safe and convenient means for manually bypassing and isolating the ATS, regardless of the condition or position of the ATS. The BPS must also be able to be used as an emergency back-up system in the event of ATS failure. Operation of the BPS must be assured, regardless of the position of the ATS. In addition, the BPS must be used to facilitate maintenance and repair of the ATS. The ATS must be completely isolated from the BPS by means of insulating barriers and separate access doors to positively prevent a hazard to operating personnel while servicing the ATS.

Inherent double-throw (break-before-make) operation of the BPS must provide positive assurance against accidentally short-circuiting the normal and alternate power sources. Arrangements using the interlocking of single-throw devices are not acceptable. The operating speed of the contacts must be independent of the speed at which the handle is moved.

The BPS must be fully manually operated and must not be dependent upon electrical operators, relays, or interlocks for operation.

Provide indicating lights to show the BPS in the bypass position, in the fully isolated position, and to indicate source availability. Include a maintained-type test switch to simulate a normal power failure. Mount two auxiliary contacts, rated at 15 amperes, 120 volts, on the main shaft, one closed on normal and one closed on emergency. Wire both contacts to a terminal strip for ease of field connections. Provide one set of relay contacts that open upon loss of the normal power supply.

All control wires must be 600 volt, SIS switchboard-type. Identify all control wire terminations with tubular, sleeve-type markers.

SUBMITTALS

Submit the following design and construction documentation:
- Designer Submittals
- Submit switch size calculations.
- Construction Documents
- Product Data
- Shop drawings and product data
- Parts list
- Operations and Maintenance Data
- Submit operation and maintenance instructions.
- Product Standards
- Ensure that all products conform to UL 1008, Automatic Transfer Switches standards.

Manufacturers

Subject to compliance with the design requirements, provide products by one of the following manufacturers:
- ASCO
- Cummins
- Zenith

- Caterpillar

Both the ATS and BPS must be supplied by the same manufacturer. The manufacturer must verify that the design has been in continuous production for not less than five years, with at least ten similar installations operating continuously and successfully for that period of time.

QUALITY CONTROL TESTING

Factory testing must be in accordance with UL Standard 1008 for Automatic Transfer Switches and certified by a nationally-recognized testing laboratory.

During the three-cycle closing and withstand tests, there must be no contact welding or damage. Perform the three-cycle tests without the use of current limiting fuses. Furnish oscillograph traces across the main contacts to verify that contact separation has not occurred,
and that there is contact continuity across all phases after completion of testing.

When conducting temperature rise tests, the manufacturer must include post-endurance temperature rise tests to verify the ability of the transfer switch to carry full-rated current after completing the overload and endurance tests.

The manufacturer must provide certified copies of factory test reports upon request.

INSTALLATION GUIDELINES

Relays, timers, control wiring, and accessories must be front-accessible.

QUALITY CONTROL

Demonstrate proper transfer operation by opening the circuit breaker or switch in normal distribution system on the line side of the transfer switch. After an alternate source is operational, demonstrate re-transfer by closing the breaker on the normal side. Demonstrate re-transfer again by opening the breaker on the normal side. After transfer, test immediate re-transfer by closing the breaker on the normal side and opening the breaker on the alternate side during the timing period.

SECTION 16442

PANELBOARDS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for panelboards, including distribution panels and branch circuit panels

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Location
Panelboards shall not be located in public hallways. Panelboards shall be located in electrical rooms that are not used for any other purpose.

Non-linear Loads
Harmonic distortion in areas of large electronic loads should be considered in the electrical design. If no other means are provided for mitigating the effects of harmonics, panelboards listed for use with non-liner (electronic) loads shall be specified.

Where possible, provide separate panelboards to serve each of the following load classifications:

Lighting
Motors and general-use receptacles

Equipment requiring clean power

Panelboards must be surface-mounted in electrical closets, where electrical closets are available. Where electrical closets are not available, locate panelboards in mechanical rooms or similar unfinished areas where surface mounting is permissible. Door hinges must be piano type, double hinged, with a lockable latch.

Where electrical closets, mechanical rooms, or similar unfinished areas are not available and panelboards must be located in finished areas, flush-mount the panels in walls with all branch circuit conduits concealed within the walls. Provide spare two-inch conduit to a spare 12-inch by 12-inch junction box mounted in an accessible, concealed location.

All distribution boards, motor control centers, and branch circuit panels shall have a minimum of 10% spare positions, but in case less than 6 poles.

Where panels are installed flush with the walls, empty conduits shall be extended from the panel to an accessible space above or below. A minimum of one ¾ inch conduit shall be installed for every three single pole spare circuit breakers or spaces, or fraction thereof, but not less than two empty conduits.

All panelboards shall have bolt in breakers.

Where underfloor space is accessible, spare conduits shall be extended there in addition to the ceiling space. Panels shall have a typewritten directory giving circuit numbers and a complete description of all outlets controlled by each panel circuit breaker.

Panelboards rated at 100 amperes must contain space for 30, single-pole circuits. Panelboards rated at 225 amperes must contain space for 42, single-pole circuits. At a minimum, panelboards must contain space for 125 percent of the active poles. Where necessary, provide double panels to conform to this requirement. No less than 6 poles.

Include in each panelboard a minimum of one spare, 20-ampere, 1-pole circuit breaker for every 750 square feet of floor area served by such panelboard.

Equipment
Panelboards must include the following features:

A copper bus with a full-capacity neutral. Where individual neutrals cannot be provided due to raceway size restrictions, multi-wire branch circuits may be
provided with a neutral conductor ampacity sized at 200 percent of the over-current protective device setting (see Section 16120: Conductors and Cables). Increase the panel neutral accordingly.

A ground bar. Panels on clean power systems shall include additional insulated/isolated ground bar.

A hinged cover with externally-accessible screws.

Bolt-on circuit breakers.
Where system expansion is anticipated, provide panelboards with feed-through lugs or sub-feed lugs.

Load centers are not acceptable.

Panelboards must be fully bussed with mounting brackets for all positions, including spares.

PRODUCT STANDARDS

Ensure that all products conform to the following standards:
- NEMA PBI, Panelboards
- UL 50, Electrical Cabinets and Boxes
- UL 67, Electric Panelboards

Manufacturers
- Cutler-Hammer
- Square D
- General Electric
- Siemens

These are the only acceptable manufacturer's of electrical panel boards.

INSTALLATION GUIDELINES

Where panelboards are flush-mounted in fire-rated walls, include installation details to maintain the fire resistance rating of the wall assembly.

Panelboard Designation Format
Panelboard designations must adhere to the following format, which provides identifiers for system type and panel location, separated by a slash (for example, HPP/3M1, ELP/B2, CP/1).

The first component of the system identifier must indicate the type of distribution system.
- For normal systems: no letter.

- For alternate systems, use the letter A.
- For emergency systems, use the letter E.
- For standby systems, use the letter S.

The second component of the system identifier must indicate the system voltage level.
- For systems of 240 volts and below: no letter.
- For systems of 480 volts, use the letter H.
- For direct current systems, use the letter D.

The third component of the system identifier must indicate the classification of loads served.
- For lighting, use the letters LP.
- For ordinary power, use the letters PP.
- For clean power, use the letters CP.
- For the main distribution panels (maximum of one per building for
- each voltage level), use the letters MDP (a location identifier is not required).

The first component of the location identifier must indicate the floor on which the panel is located.
- For sub-basements: use the letters SB.
- For basements: use the letter B.
- For numbered floors: use the floor number (for example, I).
- For mezzanines: use the number of the floor number from which access is gained followed by the letter M (for example, 2M).
- For attics: use the letter A.
- For penthouses: use the letter P.

The second component of the location identifier must indicate the location of the panel on the floor (for example, by riser number, entryway, or building sub-division).

The third component of the location identifier must indicate supplementary information, when applicable (for example, sections of multiple panels or the sequence of sub-panels).

Identification Requirements
For the panel front, provide an engraved, phenolic nameplate indicating the panel designation.

The directory must be typewritten and indicate circuit designations assigned in the panel schedule.

Number all circuit wiring with preprinted, adhesive identification labels.

QUALITY CONTROL

With all connected loads energized, measure the current in each phase and neutral of the panel feeder, and submit the results to UNLV.

SECTION 16443

MOTOR-CONTROL CENTERS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for motor control centers.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Motor control centers must consist of the following components arranged in a single assembly, as described in this section. Additional or alternative devices may be provided, as necessary, to suit particular applications.

Disconnect switches, circuit breakers, and motor controllers, as described in Section 16410:
- Enclosed Switches and Circuit Breakers and in Section 16420: Motor Controllers.
- Fuses, as described in Section 16491: Fuses.
- Single-sided lineups are the preferred arrangement. Avoid back-to-back arrangements.

Equipment
Provide motor control centers with Class 1, Type B wiring, track-mounted terminal blocks for power, and control wiring mounted in the units, unless the specific application requires otherwise.

All bus bars must be tin-plated copper. The neutral bus must be half-size, unless design conditions require a larger neutral. Provide horizontal and vertical ground busses.

Specify full bussing in all vertical sections, with a minimum of 25 percent of the layout available for future use.

Design motor control centers and their components for available short-circuit current, but not less than 30,000 amperes RMS symmetrical.

Provide motor control centers with bus barriers and bottom covers to reduce risk of accidental contact.

Specify NEMA 12 enclosures for motor control centers located in mechanical rooms.

Identify each motor control center and individual unit therein using an engraved nameplate, as described in Section 16075: Electrical Identification.

SUBMITTALS

Submit the following design and construction documentation.

Designer Submittals
- Submit control center layout detail (on construction drawings).

Construction Documents
- Shop drawings and product data
- Service manuals for operation and maintenance

PRODUCT STANDARDS

Ensure that ail products conform to the following standards:
- NEMA ICS 2, Industrial Control Devices. Controllers, and Assemblies
- UL 845, Electric Motor Control Centers

MANUFACTURERS

Subject to compliance with the design requirements, provide products by one of the following manufacturers:
- Cutler Hammer
- Allen Bradley
- Square D

INSTALLATION GUIDELINES

Install motor control centers on a four-inch concrete housekeeping pad. Wherever possible, size and locate the pad to allow the addition of future vertical sections.

START-UP AND TRAINING

Follow the procedure recommended in standard NEM A PB 1.1 to energize motor control centers.

SECTION 16450

ENCLOSED BUS ASSEMBLIES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for enclosed bus ducts rated at 225 amperes and higher.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Size bus ducts at standard ratings equal to or greater than the smaller of the following:

- 160 percent of the connected load
- The full-load transformer rating on the line side of busway
- Bus ducts must be derated where ambient temperatures are expected to exceed 40°C.
- Do not run bus ducts through fire-rated walls or partitions, unless fittings are specifically listed for such use.
- Size busses in accordance with the NEC.

Equipment

Except where feeder-types are specifically required, bus ducts must be plug-in types consisting of standard 10-foot sections, with special sections and fittings necessary to suit the installation. Feeder sections must be interchangeable without the use of special joint covers.

Size neutral busses according to feeder neutral sizing requirements. Specify an internal ground bus sized at 50 percent of the phase bus rating. Design busways for a maximum 55°C temperature rise above a 40°C ambient temperature. Brace busways to withstand a minimum 50,000-ampere short-circuit current.

Joints for busways rated at 600 amperes and higher must be of single-bolt design and permit safe testing of tightness without de-energizing. One side of the bus duct must be removable for access without disturbing adjacent sections. Provide joint covers with captive hardware.

Bus ducts must be non-ventilated and capable of being mounted in any position without derating. Horizontal runs must be suitable for hanging on 10-foot centers. On vertical runs, provide one adjustable hanger per floor.

Bus plugs must be circuit breaker types, but fused disconnect types may be used to feed individual motor circuits, if plugs are readily accessible.

SUBMITTALS

Submit the following design and construction documentation.

Designer Submittals:

- Submit calculations for sizing bus ducts.

Construction Documents
- Submit shop drawings and product data.

PRODUCT STANDARDS

Ensure that all products conform to the following standards:
- NEMABUI.Busways
- UL 857, Busways and Associated Fittings

MANUFACTURERS

Subject to compliance with the design requirements, provide products by one of the following manufacturers:
- Cutler-Hammer
- General Electric
- Siemens/ITE
- Square D

MATERIALS

Use plated copper bus bars with polyester insulation or barriers to isolate the bus bars from each other and from the housing.

Use steel housings with an enamel finish.

INSTALLATION GUIDELINES

Run horizontal bus ducts at ceiling level.

Provide expansion fittings where straight runs exceed 150 feet and where runs of bus duct cross building expansion joints.

QUALITY CONTROL

Test with megohmmeler or high potential voltage prior to energizing to be sure that excessive leakage paths between phases and ground do not exist.

Verify that a proper phase relationship exists between the bus duct and associated equipment.

SECTION 16461

DRY-TYPE TRANSFORMERS/UNDER 600 VOLTS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for low-voltage, dry-type transformers.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Design transformers for continuous operation (24 hours per day) at rated KVA, with normal life expectancy.

All transformers must be of a delta-wye configuration, except where small loads require buck-boost transformers connected as autotransformers to change from 240 volts to 208 volts, or vice versa.

Transformer impedance levels must be minimum of three percent to limit short-circuit currents on secondary systems.

Transformers serving loads which generate excessive harmonics in the grounded circuit conductor, as defined for feeders in Section 16120: Wires and Cables, must be selected with K-factor ratings suitable for the load served. Such transformers must be of a delta-wye configuration, three-legged core construction, with full-width copper electrostatic shielding. Because there is no low-impedance path for the third harmonic current, three single-phase transformers and open delta arrangements are not acceptable.

Transformers under 500 kVA can be air cooled. All transformers must have copper windings.

Equipment
Transformers must be dry-type with a 150°C total temperature system based on an 80°C rise. All insulation materials must be flame-retardant and must not support combustion, as defined in ASTM D635, Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastic in a Horizontal Position.

Transformer cores must be constructed with high-grade, non-aging, grain-oriented silicone steel, with high magnetic permeability and low hysteresis and eddy current losses. Maximum magnetic flux densities must be substantially below the saturation point. Core volume must allow efficient transformer operation at 10 percent above the highest tap voltage. Core laminations must be tightly clamped and compressed. Coils must be wound with electrical-grade copper wiring and continuous-wound construction.

On units rated below 30 KVA, the core and coil assembly must be completely encapsulated in a proportioned mixture of resin and aggregate to provide a moisture-proof, shock-resistant seal.

On units rated at 30 KVA and above, the core and coil assembly must be impregnated with a non-hydroscopic, thermo-setting varnish and cured to reduce hot spots and seal out moisture. Install the assembly on a vibration-absorbing pad and bolt it securely to the base to minimize sound transmission.

Transformer sound levels shall not exceed the following:
- 9 KVA and below: 40 dBA
- 10-50 KVA: 45 dBA
- 51-150 KVA: 50 dBA
- 151-300 KVA: 55 dBA
- 301-500 KVA: 60 Dba

Equip transformers with voltage taps in the primary winding, as follows:
- 2 KVA and below: no taps required
- 3-9 KVA: two, five percent FCBN
- 10-25 KVA: four, 2-1/2 percent FCBN
- Above 25 KVA: four, 2-1/2 percent FCBN and two, 2-1/2 percent FCAN

Transformers enclosures located indoors must be NEMA I. Transformers located outdoors must be NEMA 3R. Wiring compartments must be suitable for conduit entry and large enough to allow convenient wiring. The core must be visibly grounded to the enclosure:
- On units rated below 30 KVA, the enclosures must be totally enclosed, non-ventilated, and equipped with lifting eyes.
- On units rated at 30 KVA and above, enclosures must be ventilated and equipped with lifting holes.

SUBMITTALS

Submit the following design and construction documentation.

Designer Submittals
Submit calculations for selection and sizing of ail transformers, including:
- Connected load
- Future loads
- Harmonics
- Temperature considerations

Construction Documents
- Shop drawings and product data
- Factory test results
- Operation and maintenance instructions

PRODUCT STANDARDS

Ensure that all products conform to the following standards:
- NEMA ST20, Dry-Type Transformers, for general applications
- NEMA TR27, Commercial, Institutional, and Industrial Dry-Type Transformers
- UL 506, Specialty Transformers
- UL 1561, Large General Purpose Transformers

MANUFACTURERS

Subject to compliance with the design requirements, provide products by one of the following manufacturers:

- Cutler-Hammer
- General Electric
- Siemens
- Square D

QUALITY CONTROL TESTING

Perform ratio tests on the rated voltage connection and on all tap connections.

Perform polarity and phase-relation tests on the rated voltage connection.

Perform applied and induced potential tests.

Perform the following additional tests on transformers larger than 500 KVA:

- Resistance measurements on all windings on the rated voltage connection of each unit and at the tap extremes of the first unit made of a new design.
- No-load and excitation current at rated voltage on the rated voltage connection.

INSTALLATION GUIDELINES

Secure transformers to the building structure in compliance with the seismic provisions of the State Building Code, but in such a manner that vibrations are not transmitted to the structure during operation.

Make provisions to prevent heat buildup within transformers and within rooms containing transformers.

QULALITY CONTROL

Perform insulation resistance and moisture tests prior to energizing a transformer.

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Technical Design Guidelines

SECTION 16491

FUSES

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section contains design criteria for fuses rated at 600 volts and less.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Select the short-circuit interrupting ratings of fuses in accordance with a short-circuit analysis that accounts for all current sources and impedances between the sources and the fuses. The minimum interrupting rating must be 50,000 amperes.

Selectively coordinate all fuses for all fault and overload conditions so that a fuse clears before any over-current device on its line side and remains intact throughout the clearing lime of any device on its load side.

Current limiting fuses may be specified, where appropriate, based on the results of the short-circuit and coordination studies described in paragraphs I and 2.

Fuses for use on motor circuits must incorporate time delay characteristics to pass motor starting currents.

PRODUCT STANDARDS

Ensure that all products conform to the following standards:
- NEMA FUI, Low-Voltage Cartridge Fuses
- UL 198C, High-Interrupting-Capacity Fuses, Current-Limiting Types
- UL198E, Class R Fuses

Manufacturers
Subject to compliance with the design requirements, provide products by one of the following manufacturers:
- Bussmartn
- Economy
- Gould Shawmut
- Littelfuse

MATERIALS

Fuses connected directly to switchboard buses must be Class L. All other fuses must be class RK5, unless specific design conditions require class RKI.

The following fuses are not acceptable:
- Class G fuses
- Class H fuses
- Class J fuses

- Class T fuses
- Plug fuses
- Renewable fuses

Installation Guidelines
Install fuses so that ratings are readily visible.

Specify spare fuses as follows:

- Two sets of three fuses of each size and type installed in main distribution center and distribution switchboards.
- Ten percent, but not less than three additional fuses for each size and type of fuse used in all other locations.
- Provide cabinet for spare fuses. Cabinet shall be installed where directed by Facilities Management.

SECTION 16511

INTERIOR LIGHTING

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

A. This section contains design criteria for interior lighting systems.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

General

A. Design lighting systems to achieve required levels of illumination while minimizing energy consumption. Select lamps and luminaires for high efficiency. Interior lighting systems must operate at the highest practical voltage level available. Specify high reflectivity interior finishes to achieve the following minimum reflectances:
   - Ceilings: 80 percent
   - Walls: 50 percent
   - Floors: 20 percent

B. Incorporate natural day lighting in the design to greatest extent possible to replace or supplement artificial lighting.

C. Use windows, clerestories, and skylights to admit light into interior spaces. Use control devices, such as blinds, diffusers, and light shelves to control distribution, brightness, and glare.

D. Arrange interior lighting systems so appropriate areas can be switched off or dimmed when adequate natural light is present. Where applicable, provide control by the following means:
   - Programmable central control systems (mandatory in new construction)
   - Wall switches placed for occupant convenience
   - Occupancy sensors
   - Dimming controls, which may include multi-level stepping or switching
   - Photo sensors

E. The lighting system shall be designed with maintenance access in mind. Maintenance includes changing lamps, replacing diffusers, and repairing luminaries. An alternative maintenance access method shall be provided to any light fixture that us not reachable by portable means.

F. Use LED as the primary source of illumination for all new construction. Any mention of fluorescent lighting in these standards is referring to small projects with a need to match adjacent areas. Any use of fluorescent for small projects require the approval of the project manager.

G. Design interior lighting systems to conform to levels in IES handbook.

H. In occupancies where specialized tasks are performed (for example, at serving areas in dining halls and at mirrors in toilet rooms), the illumination levels listed in paragraph 3 might not be sufficient for adequate illumination. At such locations, increase the ambient lighting levels as necessary. Ambient lighting may also be supplemented by task lighting with the approval of the UNLV Project Manager (the ambient level should not be less than one-third the level at the task).

I. Design exterior lighting systems to achieve a minimum illumination level of 1 maintained horizontal footcandles at ground level along main walkways, with a maximum uniformity ratio of 6:1. Provide luminaires at all building entrances. The UNLV Project Manager will determine lighting levels in other exterior occupancies. Coordinate all new exterior lighting with existing lighting so that areas are not lit excessively.

J. Arrange lighting throughout all critical areas (including egress areas, assembly occupancies, health care facilities, and public safety operations) so that failure of any single element of the system, such as a

K. lamp, driver, ballast, switch, circuit breaker, or conductor, does not leave any portion of a critical area in darkness or illuminated at less than the levels required by code.

L. Where only the normal distribution system is available, provide self-contained emergency lighting units connected to an unswitched lighting branch circuit conductor.

M. Where both normal and alternate distribution systems are available, lighting fixtures must alternate between each source along the entire length of the critical area.

N. In lighting calculations, maintenance factors (LLD x LDD) must not exceed 0.65.

O. Interior and Exterior light sources must be LED, except when approved by the Planning and Construction Project Manager.

P. Lighting control shall be via Lutron Quantum Total Light Management and be connected to the existing UNLV light management server for remote control and monitoring.

Q. In areas where variable levels of illumination might be required by multiple users of the space, or for energy conservation purposes, provide multi-level switching or dimming capabilities. Such areas can include auditoriums and lecture halls, classrooms, gymnasiums, laboratories, offices, and workshops.

R. Use motion sensors to control lighting in areas subject to extended unoccupied periods during normal hours of occupancy. Such areas include the following:
- Classrooms
- Conference rooms
- Private offices
- Bathrooms in residential facilities (locate sensors so that the interiors of toilet stalls are within the field of view)
- Electrical, mechanical, T/D communication rooms

- Storage areas
- Laundry rooms
- Parking garages
- Use photocell-actuated combination lighting contactors to control exterior lighting systems. Mount manual-automatic selector switches on the contactors.

S. Coordinate luminaire locations with architectural features of space and with adjacent structural and mechanical elements.

T. Areas in which lighting is critical, such as means of egress, places of assembly, etc., should be provided with multiple lighting circuits fed from both normal and alternate systems so that failure of either source does not require transferring of the load. In rooms where two or more video display terminals are used, fixtures must have a minimum 0.7 visual comfort probability (VCP) value

U. Avoid custom fixtures, but minor modifications to stock fixtures are acceptable. Custom fixtures are acceptable only when necessary to preserve the architectural character of prominent spaces (for example, dining halls and common rooms in residential colleges).

V. Avoid inefficient luminaries. Coefficients of utilization should exceed 0.7 for a room cavity ratio of 1.0.

W. Luminaires recessed in fire-rated construction must be specifically listed for such use.

X. Unless required to suit specific design conditions, such as wet locations, do not specify luminaires for interior spaces that are designed for exterior use.

LAMPS

A. Avoid unusual lamps. Unless justified by specific design conditions, restrict lamp types to those commonly stocked by Facilities Services.

B. Avoid luminaires that use unusual lamps. Unless justified by specific design conditions, restrict lamp types to those described in this section.

EMERGENCY LIGHTING

A. Self-contained battery-type emergency lighting systems are acceptable only where alternate distribution systems are not available.

B. Locate emergency lighting units so that the lamps do not create excessive glare for persons traveling along egress areas to the nearest exit.

EXIT SIGNS

A. Exit signs that incorporate emergency lighting heads in one unit are not acceptable because glare from the lights obscure the exit sign during emergencies.

B. LED exit signs must be specified.

C. Exit signs must operate on 120 VAC or 277 VAC power. If not connected to an emergency distribution system, specify exit signs with battery backups that include a charger and control circuitry. Specify batteries as described paragraphs 12 and 14.

EQUIPMENT

A. Use LED lighting equipment unless approved by Facilities Management.

SUBMITTALS

A. Submit the following design and construction documents:
- Designer Submittals
- Lighting calculations or iso-foot-candle layouts demonstrating that required illumination foot-candle levels and watts per square foot will be achieved throughout all spaces, including means of egress described in Section 00706: General Electrical Design Conditions.
- Catalog cuts
- Construction Documents
- Shop drawings and product data
- Operation and maintenance instructions, with parts lists

PRODUCT STANDARDS

A. Ensure that all products conform to the following standards:
- ANSI C78.1 (with supplements), Dimensional and Electrical Characteristics of Fluorescent Lamps, Rapid Start Types
- ANSI C78.2 (with supplements), Dimensional and Electrical Characteristics of Fluorescent Lamps, Preheat Start Types
- ANSI C78.20, Characteristics of Incandescent Lamps of A, G, PS, and Similar Shapes with E26 Medium Screw Bases
- ANSI C78.21, Characteristics of Incandescent Lamps of PAR and R Shapes
- ANSI C78.1350 through C78.1359, High-Pressure Sodium Lamps
- ANSI C78.1375 through C78.1381, Metal Halide Lamps
- ANSI C82.1, Specifications for Fluorescent Lamp Ballasts
- ANSI C82.2, Methods of Measurement of Fluorescent Lamp Ballasts
- ANSI C82.3, Specifications for Fluorescent Lamp Reference Ballasts
- ANSI C82.4 (with supplement), Specifications for High-Intensity-Discharge and Low-Pressure Sodium
- Lamp Ballasts (Multiple-Supply Type)
- ANSI C82.5 (with supplement), Specification for High-Intensity Discharge Lamp Reference Ballasts
- ANSI C82.6 (with supplement), Methods of Measurement of High-Intensity Discharge Lamp Ballasts
- ANSI/UL 8750 Safety Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products.
- UL 935, Fluorescent-Lamp Ballasts
- NEMA LEI, Fluorescent Luminaires
- UL 1570, Fluorescent Lighting Fixtures

- UL 924, Emergency Lighting and Power Equipment

MANUFACTURERS

A. Select luminaires that contribute to the aesthetic appeal of UNLV facilities while maintaining high standards of quality, energy efficiency, maintainability, and cost-effectiveness.

B. The following manufacturers offer such features. However, this list does not exclude other manufacturers who, based on the experience of design professionals, might also produce acceptable luminaires.
   1. LED lighting - all:
      - Cooper
      - Cree
      - Green Creative
      - Lithonia
      - MaxLite
      - Halo

INSTALLATION GUIDELINES

A. Install lamps only in positions indicated in the lamp designation code.

B. Bond all ballast cases to the equipment grounding conductor.

C. Luminaires installed in occupancies, such as laboratories and workshops, must be oriented parallel to benches and centered over the edge of the working surface. Space luminaires to maintain a maximum uniformity ratio of 2:1.

D. Use a maximum six-foot length of flexible metal conduit to connect luminaires located in suspended ceilings to branch circuit wiring.

E. Where dual-level or multi-level switching is provided, wire luminaires so that each switch controls corresponding lamps in all luminaires controlled by the switch.

F. Connect emergency lighting and exit sign units to unswitched conductors fed from the same branch circuit serving normal lighting in the protected area.

G. Do not mount emergency lighting and exit sign units higher than 10 feet above the finished floor unless provisions are made for the maintenance of such units.

H. Center exit signs on building elements, such as corridors and doorways.

I. Luminaires must be fitted with swivels or otherwise adjusted so they hang plumb and true.

J. Pendent Luminaires must not be chain hung.

PREPARATION

A. Protect luminaires from wall and ceiling finishing operations. Do not install the exposed portions of luminaires until the finishes have been applied to the surrounding areas and allowed to dry.

QUALITY CONTROL

A. After the lamps have been in service for 100 hours, obtain footcandle measurements during periods of darkness at a sufficient number of locations to demonstrate that the design criteria have been met.

B. Test emergency lighting units by opening the circuit breakers that serve normal lighting in the areas protected by the emergency lighting units.

C. Test exit signs by opening the circuit breakers that serve normal lighting in the areas served by the exit signs.

CLEANING AND ADJUSTING

A. Clean and adjust luminaires at the end of the construction period.

SECTION 16521

EXTERIOR LIGHTING

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SUMMARY

This section contains design criteria for general, exterior-use luminaries and poles.

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

A. The primary purposes of exterior lighting are for safe passage of pedestrians and building security. The secondary purpose of exterior lighting is to illuminate signage. Lighting for aesthetic purposes and building accent shall be limited. Aesthetic and accent lighting shall be done only with prior written approval from the UNLV Office of Planning and Construction.

ILLUMINATION

A. All walkways included in a project shall have lighting provided by the project. Illumination levels shall conform to IES recommendations. Exterior building can be used to illuminate some areas.

B. Design and locate all exterior luminaires to minimize damage from vandalism.

C. Design and locate all exterior luminaires to minimize illumination of adjoining private property not owned by UNLV or its affiliates.

D. Design exterior luminaires, poles, and foundations to withstand sustained winds of minimum 90 miles per hour.

E. Avoid custom fixtures; however, minor modifications to stock fixtures are acceptable.

F. Generally all exterior doors and entries shall have illumination on the outside.

G. Use only LED fixtures of 4000 degree Kelvin rating with the highest color rendering index available for outdoor lighting.

EQUIPMENT

A. Use at least two feet of flexible cord to connect luminaires that are movable for aiming or relamping to an adjacent junction box. Specify fittings for strain relief.

B. Do not provide luminaires with fuses.

SUBMITTALS

A. Submit the following design and construction documentation:
   - Designer Submittals.
   - Submit catalog cuts.
   - Construction Documents.
   - Submit shop drawings and product data.

PRODUCT STANDARDS

A. Ensure that all products conform to the following standards:
   - NEMA FA1, Outdoor Floodlighting Equipment
   - UL 8750, Safety Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products.

MANUFACTURERS

A. Select luminaires that contribute to the aesthetic appeal of UNLV facilities while maintaining high standards of quality, energy efficiency, maintainability, and cost-effectiveness. The following manufacturers offer such features. However, this list does not exclude other manufacturers who, based on the experience of design professionals, might also produce acceptable luminaires.
   1. Area and flood lights:
      - Cree
      - Cooper Lighting
      - Holophane
      - Hubbell
      - Lumark
   2. Architectural Area Lighting:
      - Hubbell
      - Acuity Brands, Inc
      - Eaton
      - Holophane
      - Kim

MATERIALS

WALKWAY LIGHTS

A. Walkway lights shall have a luminaire similar to Cree Edge High Output LED Model ARE_EDG_5M-DA-06-E Type V distribution New installations shall match luminaries in adjacent area.

POLES FOR WALLWAY LIGHTS

A. Poles for walkway lights shall be 15 foot, natural aluminum pole with 9” bolt pattern with hinged base. New installations shall match luminaries in adjacent areas.

PARKING LOT LIGHTS AND POLES

A. Luminaires and poles for parking lot lights shall be of the same type of design as the walkway lights with pole heights up to 35 feet (non-hinged).

BOLLARDS

A. Bollard type lighting fixtures shall be similar to Lithonia KBC8-LED-16C-530-40K-SYM-MVOLT-DNAXD natural aluminum finish.

WELL LIGHTS

A. Well light fixtures shall be similar to Vista Model 1185 in 4000k with distribution and lumens to match application. Well lights shall be installed in paved areas. Well lights shall not be installed in planter beds or tree wells without concrete collar.

CLEANING AND ADJUSTING

A. Clean and adjust luminaires at the end of the construction period. If necessary, aim the lights after dark.

SECTION 16600

UNDERGROUND ELECTRICAL DUCT BANK

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

This section summarizes the design criteria for underground exterior electrical distribution systems.

System Design and Performance Requirements:
- The minimum allowable concrete duct compressive strength is 3,000 psi.
- Design all underground electrical raceways and duct banks for seismic zone 2.

SUBMITTALS

Submit the following design and construction documents to UNLV:
- Design Documents
- Plan and profile views of all design drawings
- Maximum wire pulling tension calculations for proposed conduits
- Construction Documents
- Product data on manholes, hand holes, and fittings
- Equipment and machinery proposed for bending metal conduit

PRODUCT STANDARDS

The following products are standard for UNLV:
- Underwriters Laboratories
- ANS1/NEMA 70: National Electrical Code
- National Electrical Manufacturers Association (NEMA) TC6: PVC and ABS Plastic Utilities for Underground Installations
- National Fire Protection Association (NFPA) 70: National Electrical Code (NEC)
- National Electrical Contractors Association, Inc. (NECA) 5055: Standard of Installation

Manufacturers
Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to. the following:
- Precast Manholes
- Ditullio
- Rotondo
- A UNLV approved equivalent

Manhole Covers
- Waterbury 3024 or a UNLV approved equivalent with the word "Electrical" cast into the upper surface
- Minimum 7" deep and frame

MATERIALS

Use schedule 40, rigid, nonmetallic conduit in straight sections, unless otherwise noted or specified. Use rigid steel conduit for bends, kicks, sweeps, elbows, offsets, and within five feet of wall penetrations.

Accessories or Special Features
All end seals, gland seals, and anchors must be designed and factory prefabricated to prevent the ingress of moisture into the system.

All subassemblies must be designed to allow for complete draining and drying of the conduit system.

Anchors must be manufactured to minimize the heat transfer from the carrier pipe to the jackets.

Special Requirements
Provide steel cable racks with demountable insulated cable brackets in all manholes.

Maintain a minimum grade of 4" in 100 feet, either from one manhole, hand hole, or pull box to the next, or from a high point between them, depending on surface contour.

Pipe bends must have at least a 10' radius.

INSTALLATION GUIDELINES

For pipe bedding:
Where possible, provide a uniform pipe bedding of granular material conforming to the requirements of SW, SP, or SP-SW soil classifications for on-site material. If suitable material is not available, backfill the trench with sand.

Using a material similar to the bedding, backfill the entire trench width evenly in 6" lifts to 6" above the top of the pipe. Compact the lifts to at least a 95% Standard Proctor density, meeting ASTM DI 556 standards at optimum moisture (or as recommended by the soils engineer).

Backfill the remaining trench in lifts not to exceed 12" up to the sub-grade height for the surface condition encountered. Compact the lifts to a 95% Standard Proctor density, meeting ASTM D1556 standards at optimum moisture (or as recommended by the soils engineer).

Backfilling and compacting above the sub-grade must be determined by the soils engineer or by the recommended paving design for the project.

Salvage existing topsoil and reuse it, where possible, as directed by UNLV grounds personnel. Replacement topsoil must meet UNLV grounds personnel requirements.

Leave a nylon fish tape in all spare conduits.

All conduits entering a structure must terminate with a threaded end that will accept a lock nut, connector, or grounding bushing.

Bury all ducts at least 30" below grade, unless otherwise noted. Maintain 12" of vertical and horizontal separation with other piping systems.

Unless noted otherwise, encase conduits with 3,000 psi concrete, with #5 steel reinforcing.

For each manhole, place a label on the manhole wall adjacent to the duct. Indicate the name of the manhole at the other end and the distance to the next structure. Where duct banks enter buildings, vaults, or other structures, dowel into the concrete wall with #6 reinforcing steel at the four comers of the duct bank (minimum) and every 12" around the perimeter of the duct bank. Extend the dowels at least to the depth of the wall and the same distance into the duct bank.

Union type fittings are not permitted. Stagger all couplings for multiple conduit runs.

Provide preformed, non-metallic spacers designed to secure and separate parallel conduit runs in a trench or concrete duct bank encasement. Install spacers per NPFA 70 but not greater than 10 feet.

Apply wraparound duct band with on-half tape width overlap to obtain two layers at all couplings and joints.

Empty raceways must have a permanent removable cap over each end.

Install a metal lined, plastic, 6" wide warning tape 18" above all raceways and duct banks.

Furnish and install a "Danger - High Voltage" sign at each manhole, cable chamber, junction box, pull box, and vault.

QUALITY CONTROL

Work on exterior electrical distribution systems must conform to the following quality control standards.

Testing Laboratory
UNLV will retain the services of a qualified, independent testing laboratory to perform soil compaction tests, as directed, during construction.

All materials within the scope of Underwriters Laboratories must conform lo UL standards and have an applied UL listing mark.

Testing Methodology and Extent
Inspect and test in accordance with NETA-ATS requirements, except section 4.

Perform inspections and tests listed in NETA-ATS, section 7.3.2.

Start-up and Training
A final inspection of electrical systems is required before final payment.

Contractors must provide competent instructors to train UNLV personnel in the care, adjustment, and operation of all parts of the electrical system.

SECTIONS 16741

TELECOMMUNICATIONS

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the University of Nevada, Las Vegas Project Manager.

SUMMARY

Purpose
The intent of this document is to provide a standard specification that will be used for all UNLV facilities requiring cable installation. This document provides the minimum performance criteria for the components and sub-systems comprising a complete cabling system that shall accommodate UNLV's requirements in excess of ten years.

Product specifications, general design considerations, and installation guidelines are provided in this written document. Quantities of telecommunications outlets, typical installation details, cable routing and outlet types for a specific UNLV facility will be provided as an attachment to a Request for Proposal. If the bid documents are in conflict, the Request for Proposal specification shall take precedence. The successful vendor shall meet or exceed all requirements for the cabling system described in this document.

These guidelines are intended to provide general design guidelines for new construction, and performance criteria for additions/renovations to existing facilities. Since all new construction will have telephone/data communication service raceways provided by an electrical subcontractor under the general contract, the specifications included in this document are intended as supplemental information to insure an acceptable, effective installation.

The successful contractor is required to furnish all labor, supervision, tooling, miscellaneous mounting hardware and consumables for each cabling system installed. The contractor shall maintain current status with the warranting manufacturer, including all training requirements, for the duration of the contract. The Contractor shall staff each installation crew with the appropriate number of trained personnel, in accordance with their warranty. After installation, the Contractor shall submit documentation to support a contractor installation 10-year warranty. The 10-year warranty will cover the components and labor associated with the repair/replacement of any failed link, which is a valid warranty claim, within the warranty period.

Related Documents
Equipment and material shall be Underwriter's Laboratories listed and labeled. The latest editions of the following standards are minimum requirements. If a conflict exists between applicable documents, then the order in the list below shall dictate the order of precedence in resolving conflicts. This order of precedence shall be maintained unless a lesser order document has been adopted as code by a local, state or federal entity, and is therefore enforceable as law by a local, state, or federal inspection agency:

- ANSI/TIA/EIA- Transmission Performance Specifications for 4-Pair Category 6 Cabling
- ANSI/TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard
- ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces
- ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Building
- ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications
- National Electrical Manufacturers Association (NEMA)

- National Electrical Code, latest revision (NEC)
- National Fire Protection Agency (NFPA) – 70
- Local, State and Federal Codes including Nevada Revised Statute (NRS) 278.583
- Nevada State Public Works Board Adopted Standards
- UL 497 Protectors
- UL 1459 Standard for Safety for Telephone Equipment
- UL 1863 Standard for Safety for Communications Circuit Accessories
- UL 2024 Standard for Safety for Optical Fiber Cable Raceway
- UL 723 Standard for Safety for Surface Burning Characteristics of Building Materials
- UL 1581 Standard for Safety for Reference Standard for Wires, Cables and Flexible Cords
- TIA SP-4195
- National Electrical Safety Code (NESC)
- ANSI/EIA 310D

SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

Work must conform to the design requirement for each identified element.

Building Service
Plans for all new buildings shall include a design for extending the campus voice, data and video networks to the building. Consistent with this design, network trunks shall be extended as a part of the initial construction and equipment shall be installed to provide connection to the building. Every building, regardless of size, shall be constructed to allow for a 19-tube cable (Sumitomo part number TC19TLW or similar) to enter through individual 4" conduits from the campus underground plant from two diverse locations. Voice cables (minimum 50 pair) to enter from the campus underground plant from one location. In addition, every building shall be equipped with at least two empty 4" conduits to the campus underground plant for later use by UNLV after installation of all voice and data cables. All raceways to have 880 lb. nylon pull strings installed. All new service entrance conduits shall be a minimum 4" trade size and of sufficient number to provide 50% growth capacity, and will terminate 4” above finished floor in the MDF (main distribution frame) room inside the building.

Service: Data
Data communication service to each building shall consist of a minimum of 24 strands of 50/125-micron multi-mode fiber and 72 strands of 9.0/125-micron single-mode fiber and terminated at two separate major distribution locations on campus as determined by UNLV Network Development and Engineering. Fiber optic cable is to be contained in its own 19-tube air-blown cable, Sumitomo part number TC19TLA or similar. If different part number is to be used, approval must be granted by UNLV Network Development and Engineering. Multi-mode fiber is to be terminated with LC style connectors, UPC Polish and single-mode fiber is to be terminated with SC style connectors, UPC Polish. Multimode and Singlemode terminated in separate rack mounted light guides. MDF to include a Tube Distribution Unit (Sumitomo part number DE12IDU or similar). If different part number is to be used, approval must be granted by UNLV Network Development and Engineering. Each light guide must be labeled with building, and IDF room number of opposing end. Patch panels to be mounted in such a manner as to allow the maximum usage of each rack. Appropriate wire management, determined by consultation with Network Development and Engineering and with regards to building design, shall be installed. A minimum of 10 ft. of fiber-optic cable will be coiled, to meet manufacturer specifications, at both termination points. Complete IDF room design, including rack layout, power requirements, cable management will be provided by UNLV Network Development and Engineering.

Service: Voice
Voice communication service to each building shall consist of a minimum of one 24 AWG, solid annealed copper, 50 pair twisted cable. Cable to enter building through a separate, dedicated conduit. Cable to be terminated patch panel(s) in data rack(s). One pair per RJ-45 block, terminated on blue/white-blue.

Lightning protection to be provided as required per design specifications and/or applicable codes and regulations.

Service Entries
Elements of the service entry facilities design are to include type, size, gauge, and insulation of distribution cables. Every copper cable shall be bonded and grounded for lightning protection per NEC 800-30A at both terminations using solid-state 5-pin protectors, 50 to 100 volt range.

Building entry conduit shall allow for 50% growth and have a minimum of four 4" conduits from manhole to MDF room.

Manholes
All manholes shall be at minimum 4' by 4' by 4' and encased in concrete. All cable is to have service loops and be racked and mounted. Each manhole will have drainage holes and be engineered so water will not accumulate. Top of manholes are to be flush with paved areas, 6" above finished grade in landscaped areas.

Cable Splicing
Copper cable splicing is only allowed where previously approved by UNLV Network Development and Engineering. Fiber-optic cable will only be spliced at the termination point. Fiber-optic splicing must be fusion based with two fibers optic strands of the exact make and model on each end using factory terminated connectors on pigtails. Splicing is not acceptable outside of Tele/Data rooms. Epoxy based splices shall not be acceptable. The following cable splicing techniques and materials for copper cable shall be utilized:
Preparation for Splices
All copper cables shall be thoroughly cleaned and scuffed in a manner to insure a good mechanical bond when splicing. 3M Scotchcase 4435 non-conductive aluminum oxide abrasive strip, or UNLV approved equal shall be used. All cable shall be thoroughly cleaned with a non-toxic solvent, 3M Scotchcase 4414 or 4415 or UNLV approved equal.
Splicing requirements
No splice cases will be permitted in cable trays.
All splice closures for use on underground non-pressurized systems shall be manufactured of clear, self-extinguishing, tongue and groove fitting PVC.

End caps must be tapered and flexible and be capable of separate cable entries.
Rigid bonding and strain relief bars must be an integral part of the finished closure.
Re-enterable, polyurethane compound shall be used.
All cable splices must be tagged or marked showing the cable number and pair count spliced. Markings may be placed on the splice closure or on both the in and out cables.
Supports: All cable splices shall be supported by a minimum of two cable hooks. Horizontal racking for support may utilize 3M Brand RC-100 rack adapters, manhole racks, or University approved equivalent.
Closures: 3M splice closures or University approved closures will be used for splicing throughout the system.
Protection: All cable splices must be protected from damage at sheath openings by mechanically protecting all conductors utilizing 3M Scotchcase Pair Saver 4458 or approved equivalent.

Building Voice and Data Terminal Rooms
All new building structures shall have minimum one primary Data communication room in which the outside cable terminates, henceforth referred to as the Main Distribution Facility (MDF). Each building may have additional data rooms for end wiring, henceforth referred to as Intermediate Distribution Facilities (IDFs).
Main Distribution Facility (MDF) Specifications
The MDFs shall not contain any equipment not specified by UNLV Network Development and Engineering. This includes, but is not limited to, Marlok equipment, transformers, sinks, fire or building alarm equipment. They shall be kept as clear of all other equipment.

Each MDF will be provided with isolated grounds, including a 6' vertical earth ground, and an isolated electrical panel with 200-amp service.
Each MDF will have four 20 amp, 110 V.A.C. outlets, terminated with NEMA 5-20Rs and four 30 amp 208 V.A.C. outlets, terminated with NEMA L6-30Rs. All outlets will be serviced by the emergency power system and colored orange or otherwise marked as such. All outlets will be positioned within 4 feet of the rear of the provided racks, near floor level.

All MDFs shall be accessible only from inside the building. No outside entrances are permitted. All doors between the outside and the MDF must be at least 36" wide and 80" high.
Rooms will be rectangular or square, have a minimum clearance height of eight feet without obstructions (sprinklers, etc.), be at least 14' x 10', and not have false floors or ceilings.
No exposed water or gas pipes shall enter in or run through the main terminal room or data room. No drains, ducts or clean-outs will be permitted.
A separate HVAC thermostat control will be installed for all MDF rooms, and shall be air conditioned with separate zone or air conditioning unit 24 hours a day, seven days a week. A positive pressure shall be maintained with a minimum of one air change per hour.
All MDFs shall be secured using a Marlock card swipe reader and striker, the access of which is to be managed by the Network Operations Center.
All MDFs shall be provisioned with at least one standard data rack, Panduit CMR4P84CN, bolted to the floor. These rack(s) shall be placed side-by-side, with vertical cable management, Panduit part# WMPVHC45E in between and on both sides. The racks must have a minimum of 36" of clearance front and back and at least 18" on both sides. OIT provided room drawings must be followed.
Ladder rack shall be provided and installed sufficient to secure the equipment rack to the adjacent wall(s) as determined at installation and to provide support for incoming cables.
A minimum of two walls must be covered by backboards as defined in Part II.
Floor loading shall be designed to support a minimum of 1000 pounds of equipment per data rack provided.

All other elements of room to be designed and provisioned per ANSI/EIA/TIA 569 or better.

Intermediate Distribution Facilities (IDFs)
The IDFs shall not contain any equipment not specified by UNLV Network Development and Engineering. This includes, but is not limited to, Marlok equipment, transformers, sinks, fire or building alarm equipment. They shall be kept as clear of all other equipment.Each IDF will be provided with isolated grounds, including a 6' vertical earth ground.Each IDF will have four 20 amp, 110 V.A.C. outlets, terminated with NEMA 5-20Rs and two 30 amp 208 V.A.C. outlets, terminated with NEMA L6-30Rs. All outlets will be serviced by the emergency power system and colored orange or otherwise marked as such. All outlets will be positioned within 4 feet of the rear of the provided racks, near floor level.
All IDFs shall be accessible only from inside the building. No outside entrances are permitted. All doors between the outside and the IDF must be at least 36" wide and 80" high.
Rooms will be rectangular or square, have a minimum clearance height of eight feet without obstructions (sprinklers, etc.), be at least 8' x 10', and not have false floors or ceilings.
No exposed water or gas pipes shall enter in or run through the main terminal room or data room. No drains, ducts or clean-outs will be permitted.
A separate HVAC thermostat control will be installed for all IDF rooms, and shall be air conditioned with separate own zone or air conditioning unit 24 hours a day, seven days a week. A positive pressure shall be maintained with a minimum of one air change per hour.
All IDFs shall be secured using a Marlock card swipe reader and striker, the access of which is to be managed by the Network Operations Center.
All IDFs shall be provisioned with at least one standard data rack, Panduit CMR4P84CN, bolted to the floor. These rack(s) shall be placed side-by-side, with vertical cable management, Panduit part# WMPVHC45E in between and on both sides. The racks must have a minimum of 36" of clearance front and back and at least 18" on both sides. OIT provided room drawings must be followed.
Enough rack space must be provided to terminate all fiber and copper, with associated cable management, plus 200%.

Ladder rack shall be provided and installed sufficient to secure the equipment rack to the adjacent wall(s) as determined at installation and to provide support for incoming cables.

A minimum of four walls must be covered by backboards as defined in Part II.
Floor loading shall be designed to support a minimum of 1000 pounds of equipment per data rack provided.
All other elements of room to be designed and provisioned per ANSI/EIA/TIA 569 or better.

Building Interiors
Underground Plant
The cables from the underground plant shall enter the building in a MDF room. Appropriate wire management shall be installed such as ladder racks, D-rings, and tie wraps so as not to exceed the acceptable cable bend radius.

Data Rooms
Additional IDF(s) shall be provided if necessary to prevent total length of data cable runs from exceeding 300 feet. Additional IDF rooms in multistory buildings shall be aligned vertically with the MDF room if possible.

Internal Backbones (Risers)
A minimum of two 4" conduits shall run between every IDF and the MDF within buildings. Pull strings shall be provided in every conduit. Data interconnections between each IDF and the MDF shall be via fiber optic cable containing a minimum of 24 strands of multi-mode and 24 strands of single-mode fiber, as defined in Part II. Fiber optic cable is to be contained inside 7-tube air-blown conduit, Sumitomo part TC07TRX. 12 Cat6 provided between every IDF and the MDF. Patch panels are to be mounted in such a manner as to allow the maximum usage of each rack.
Station Wiring

Outlets
All outlets shall be constructed using single gang, 4-port faceplates, colored almond, AMP part number 558088-1 or similar. All outlets shall have at least two network drops each.

Cabling
All drops shall be connected with blue network cabling from patch panels to each drop location and terminated on black data jack. Every cable shall be continuous and unspliced, with data cables attached to a single port in the patch panel at one end and to a single jack at the station end. All connections are to be done using the T568B wiring scheme. No cable run from patch panel to connection point may exceed 300 feet. All cabling must terminate in an IDF or MDF room on the same floor as the outlet unless building plans, certified by Network Development and Engineering, specify otherwise. Additional specifications for cabling, patch panels and data jacks as per specifications in Part II.

Habitable Space Provisioning
Every habitable space shall be provisioned a minimum of one outlet per person planned for the space or one outlet per 60 ft², whichever is greater. If the number of people planned for a space is not known, the 60 ft² guideline must be used.

Non-habitable Space Provisioning
Every non-habitable space shall be provisioned with one outlet every 500 ft², minimum of 1 per enclosed space. Exceptions may be granted for unusual circumstances by Network Development and Engineering, in writing.

Labeling
The labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cable's origin and destination. Station identifiers shall increment starting from the jack at the right when facing into the room at the main entrance and incrementing

counterclockwise; and shall increment from left to right then top to bottom on each individual faceplate. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. All label printing will be machine generated using indelible ink. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Faceplate labels will be the manufacturer's labels provided with the outlet assembly unless otherwise specified. As-builts & test results to be provided in .PDF and CAD format. The labeling schema shall be as follows:

Data Room Patch Panel
All patch panels shall be labeled in the format "### - X", where ### is the station room number, and X is the station identifier discussed above. All wireless drops must be labeled in the format "W###-X".

Station Jack
All station jacks shall have the data drops on the patch panel and the station numbers labeled on the faceplate. The top label of the jack must be in the format of "### X-Y". ### being the station room number. "X" being the first data drop present at that faceplate location, and "Y" being the last data drop present at that faceplate location. In addition, each jack shall have an individual label placed adjacent to the jack on the perimeter of the faceplate. This label will be a single number from the X-Y range and shall be ordered from left to right and top to bottom. This number range shall start at one and increment up to the last jack in the room. The first increment for each room is one. The bottom label must also include the room number of the IDF that jack pulls to. See "Standard Outlet Configuration" in section 4.

Wireless: 802.11
All wireless locations shall be mounted parallel to the ceiling, above the drop-ceiling grid panels. Two blue data cables shall run from a patch panel to data jacks in the box. These locations shall have a minimum clearance of 14" x 14" x 8". No cable run from patch panel to connection point may exceed 300 feet.

Wireless Access Point Placement and Wireless Overlay for 802.11
Locations will be specified by consultation with UNLV Network Development and Engineering. The use of 3rd party professional RF Engineering design may be required under the special conditions. These conditions include but are not limited to the following:

Any wireless bridge installation which requires rooftop cabling and mounting of wireless bridging hardware, antennae and masts.

Installations which require access points to use antennae other than the standard dipole antennae.

The finished ceiling plan is exposed and the customer has specified that wireless hardware and antennae placement must be as limited as possible in order to meet aesthetic requirements of the building Consultation with UNLV Network Development and Engineering is required for all 802.11 Wireless infrastructure design.

Cable Trays
All cable trays must be UL rated and approved by UNLV Network Development and Engineering prior to their inclusion in specifications.

Supports
Cable trays for horizontal distribution cables, utilizing a center support hanger method to support the cable trays, will utilize threaded rods of not less than 1/2" in diameter.

Capacity
Cable trays shall be sized for a minimum growth of 50%.

Installation
Installation is to meet or exceed ANSI/EIA/TIA 568-B and ANSI/EIA/TIA 569. Completed installation is to be Certified Category 6 using the TIA TSB-95 testing standard or better. Test documents/results to be supplied to UNLV in .PDF and Linkware format. Completed installation is to be approved by UNLV Network Development and Engineering.

Pull and Splice Boxes

Location
Pull boxes must be installed in easily accessible locations. It is not permissible to locate a pull box in the ceiling for conduits larger than 2" in diameter. Conduits larger than 2" diameter, entering a box shall be routed down a wall or column and the box shall be installed accordingly. All pull boxes shall be placed in a straight section of conduit. Align the corresponding conduits at each end. All boxes shall be properly and adequately secured. They are not to be supported by the conduits entering the box. Install boxes for station cabling immediately above the suspended ceiling.

Access
Provide boxes with a suitable cover.

Grounding

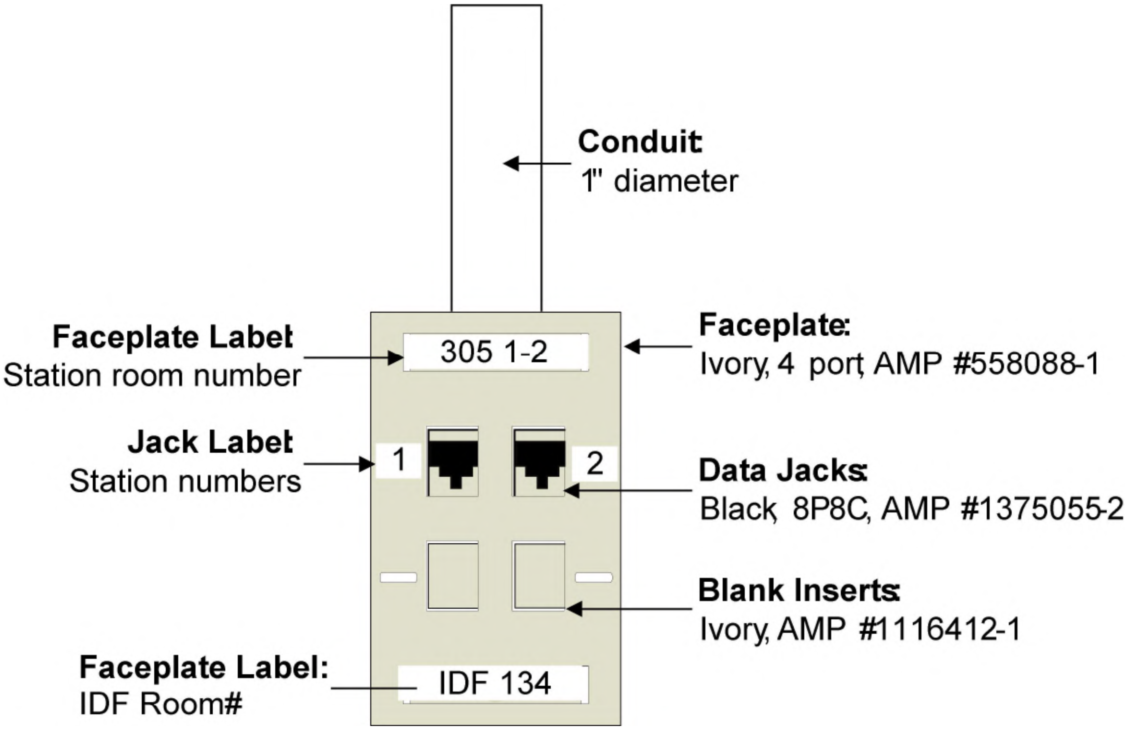
Regulations
All conduit and cable tray systems, supports, cabinets, equipment, etc., shall be properly grounded in accordance with the latest edition of the National Electrical Code (NEC) and all other applicable codes and regulations.

Installation Requirements
Provide all bonding wire and jumpers, grounding bushings, clamps, etc., required for complete grounding. Route ground conductors to provide the shortest, most direct path to the ground electrode system.

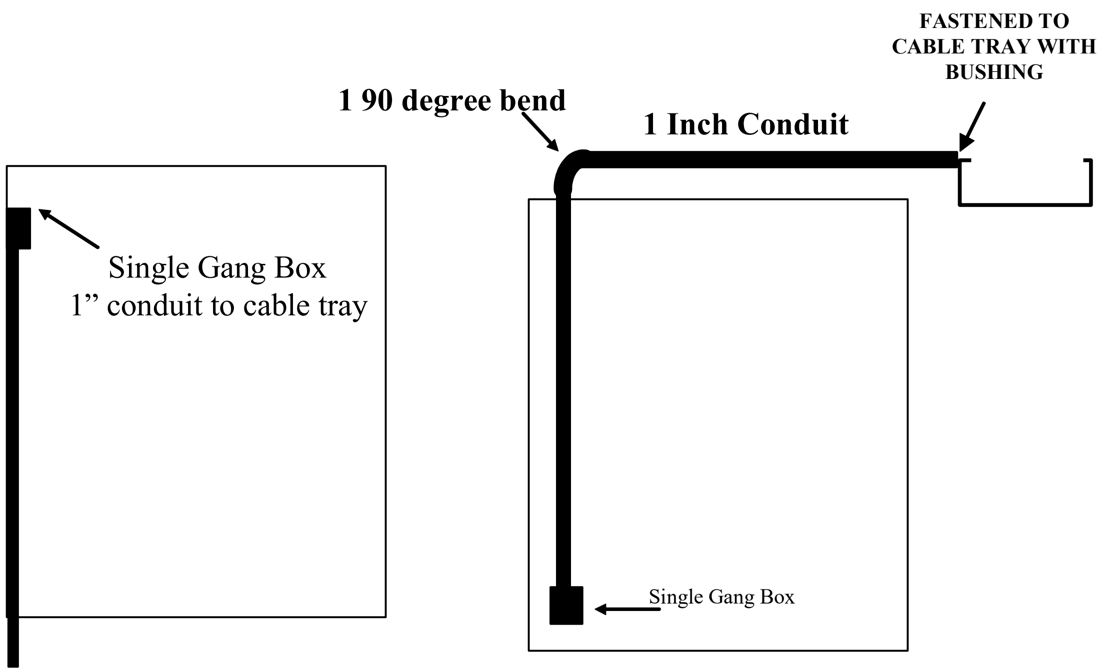
Grounded Connectors
Provide a separate grounding conductor, securely grounded on each side of all conduit and cable trays that do not provide a continuous, metallic path. Size shall be in accordance with the National Electrical Code (NEC). All ground connections will have clean contact surfaces, tinned and sweated while bolting. Avoid splices in bonding or grounding conductors. If splices are required they must be cad welded. Any grounding or bonding conductor that is run through a metallic conduit should be bonded to the conduit on both ends. Do not use a gas pipe as the grounding electrode.

IDF/MDF Room Grounding
All IDF and MDF rooms require an earth ground. Additionally, if the IDF/MDF room houses telecommunications switching or fiber remote equipment, single point of ground technology is required. This requires a separate ground bus in the service panel to the building transformer; otherwise power receptacles in the room must be isolated and grounded together with a number 6 AWG or larger copper wire.

Standard Outlet Configuration



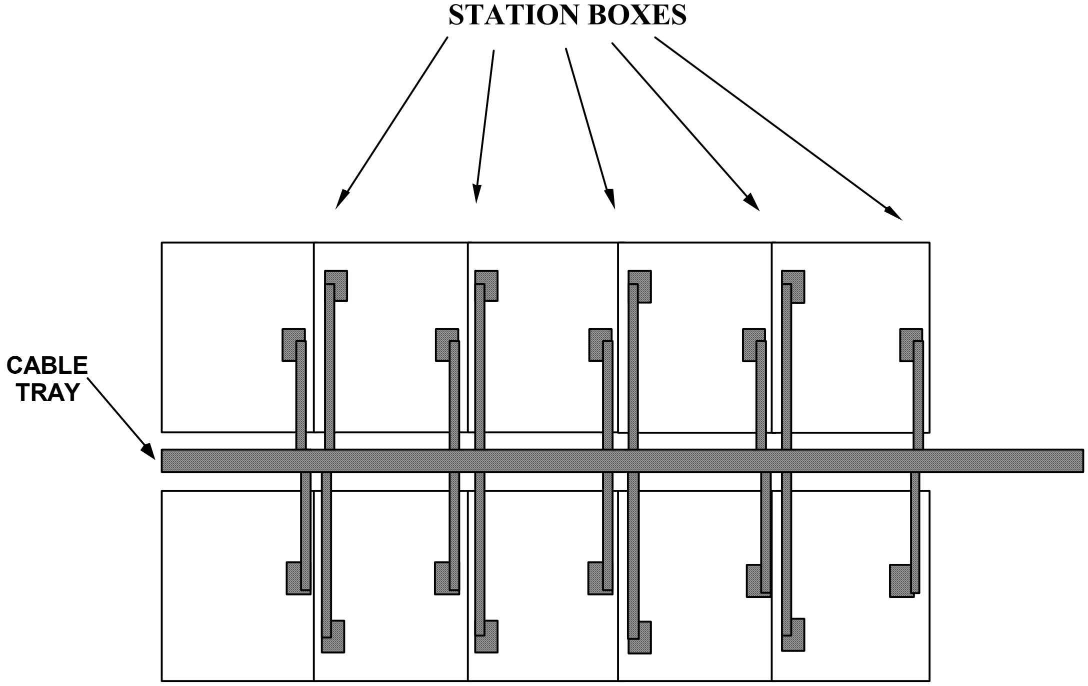
Standard Conduit Routing



PLAN VIEW

ELEVATION VIEW

STATION BOXES



MATERIALS

Backboards
All backboards required in the IDF/MDF rooms shall be plywood, ¾", 4' by 8' sheets, grade A, treated on one side with fire resistant paint or material, installed with finished side exposed.

Cable Specifications

Data Copper
All copper data cable must be Category 6, 4 pair, UTP (Unshielded Twisted Pair). Accepted materials are Belden 2412 for non-plenum spaces, and Belden 2413 for plenum spaces. Equivalent cable must be verified by UNLV Network Development and Engineering. All terminations are to follow ANSI/EIA/TIA 568-B.

Exterior Cable
All telephone cable that supports devices external of a building such as emergency phones use Superior Essex cable part number 09-092-02,6 pair buried drop.

Multimode Fiber Optic
All multimode fiber optic cable must 50.0/125 micron inside 19-tube air-blown conduit, Sumitomo part number FB24M5 (24 Strand). All multimode terminations are to be LC, UPC finish.

Singlemode Fiber Optic
All singlemode fiber optic cable must be 9.0/125 micron inside 19-tube air-blown conduit, Sumitomo part number FB24SX (24 strand). All singlemode terminations are to be SC, UPC finish.

Data Terminations

Data Copper Patch Panels
All data patch panels are to be 110 block, Category 6, in either 1U, 24 port or 2U, 48 port configuration, and must meet or exceed EIA/TIA and ISO/IEC Category 6/Class E requirements. AMP parts 1375014-1 (24 count) or 1375015-1 (48 count) or equivalent. Every group of 48 must be separated by 1U of horizontal cable management, Panduit part# NCMHF1. All terminations are to follow ANSI/EIA/TIA 568-B.

Voice Copper Termination Blocks
All voice wire terminations are to be terminated on patch panel(s) in data rack(s). One pair per RJ-45 block, terminated on blue/white-blue.

Copper Data Jacks
All modular data jacks shall be unshielded, 4-pair, 8P8C, 110 block, Category 6, black, unless otherwise specified, and must meet or exceed EIA/TIA and ISO/IEC Category 6/Class E requirements. AMP parts

1375055-2 or equivalent. All terminations are to follow ANSI/EIA/TIA 568-B. All faceplates shall be 4 port, light almond, single gang, low profile, AMP part 558088-1 or equivalent.

Fiber Optic
Multi-mode fiber is to be terminated with LC style connectors, UPC Polish and single-mode fiber is to be terminated with SC style connectors, UPC Polish. Multimode and Singlemode terminated in separate rack mounted light guides.

Data Equipment Racks
All racks are to be four post, open frame, square hole, black, Panduit part number CMR4P84CN. Substitutions must be authorized in writing by UNLV Network Development and Engineering.

Cable Trays
All cable trays are to be a minimum of 18” wide by 4” deep, solid trough or ladder. Thomas & Betts #(HG(PG for pre-galvanized)1-4)-18-S(L09 for ladder with 9” rung spacing)-144 or equivalent, with associated fittings, hardware, and supports.

Exceptions
Exceptions may be authorized for existing buildings only with approval of UNLV Network Development and Engineering and shall be granted in writing.

Installation Guidelines
The University has drawings detailing existing cable runs, terminal cabinets/closets, risers, etc. Copies may be obtained from UNLV Network Development and Engineering to facilitate the requirements of Part III - Execution.

Unless otherwise expressly provided in the Contract, any provisions of the standard specifications, which require the University to inspect certain material or work, shall mean that the University has the option, rather than the obligation, to do so. Any warranty or guarantee provisions contained in the Contractors'/Vendors' standard specifications shall be of no effect and the warranty and guarantee provisions, if any, of the Contract shall apply.

Examination
The minimum concrete pour depth shall 3-1/2 inches (89mm).
With Installer present, verify that manufacturer's requirements for floor opening and infrastructure conditions have been satisfactorily met. Proceed with installation only after unsatisfactory conditions have been corrected.

Preparation
Arrange for jobsite approval of the equipment prior to commencing installation.
Verify exact locations of f1oorbox installation.

INSTALLATION

Install equipment in compliance with approved shop drawings and manufacturer's installation instructions.

Install in position and relationship to adjoining work indicated, securely anchored to supporting structure, sealed and finished, and in a manner, which produces a level box with square, plumb, and straight edges.

Telecommunications Cabling Floor box shall have a total of three separate EC with pull string at each box as follows:

One 3/4-inch EC from box to circuit panel. (Duplex AC Power)

Two 1-1/4 inch EC from box to telecomm cable tray A.F.C (CAT. 6 data cables)

Coordinate installation with floor covering to finish each floor box. Install floor covering with oversized cable management pop-up pass-thru in top, matching surrounding floor covering in cover insert.

Adjusting
Adjust door and cover for proper operation.

Protection
Protect installed equipment in original undamaged condition until Substantial Completion. Remove and provide new components or units that cannot be repaired to the satisfaction of the Architect.

Demolition

Coordination with University Operations

No telecommunication or data jacks, cabling terminals, or other hardware will be moved, disconnected, or removed without prior approval of UNLV Network Development and Engineering. Coordination of demolition activities with the departments will be strictly enforced to minimize service disruptions.

Work to be Performed by Owner

Upon notification by contractor, UNLV Network Development and Engineering will dispatch a technician to the requested work location. The technician will determine if the facilities to be moved or removed are in service (hot) or out of service (dead). If station cabling is dead the technician will insure that all cross-connects have been removed. If the facilities to be moved or removed are determined to be in service, the technician will take the necessary actions to render the facilities dead. Under NO circumstances will removal of telecommunications or data facilities begin until UNLV Network Development and Engineering has ensured that services are dead.

Disposal of Surface-Mount Raceway

Surface mount raceway that has been vacated, or otherwise determined not required, will be removed after all cabling has been properly removed.

Excavation

The Contractor shall be required to excavate for underground mechanical piping, and shall perform all auxiliary work that may be required to do so.

No trenching will commence until UNLV Planning and Construction and UNLV Network Development and Engineering grants approval. The University has drawings of existing underground utilities to assist the Contractor to locate all underground utilities. All Contractors are to Call Before U Dig. All lines damaged by Contractor will be repaired at Contractor’s expense.

Asphalt and concrete pavement shall be sawed or cut to a depth necessary to bring about a straight-line break parallel to the sides of the trench, so as not to disturb the adjoining pavement.

All underground construction work, during progress and after completion, shall conform truly to lines and grades.

If the trench is excavated to a greater depth than that given, the Contractor shall, at his own expense, bring such excavation to required grade with such material as directed, notwithstanding that it may be necessary to bring such material from other localities or to purchase suitable materials.

The material excavated shall be deposited along the side of the trench in such a manner as to create the least inconvenience possible.

Contractor shall not obstruct the gutter of any street or driveways, but shall use all proper means to provide the free passage of surface water along the gutters into storm water inlets. Contractor shall provide channels where required.

Special care shall be taken to keep all fire hydrants and gate valves on water mains accessible at all times. Fire lanes are to be kept open.

Wherever required, sides of the trench shall be sheeted and braced in strict accordance to the rules, orders and regulations of the State, County, and the City. Trenches shall be barricaded.

Grass will be replaced by a method approved by the University.

Bricks, blocks and other debris removed from trenches will not be used as fill for trenches.

INSTALLATION REGULATIONS

All work and materials will comply with all federal and State laws, municipal ordinances, codes, regulations and direction of inspectors appointed by proper authorities having jurisdiction.

If there are violations of codes, the vendor will correct the deficiency at no cost to the University.

Working conditions must meet the industry standards for safety and work procedures, and protection of property established by prevailing rules, regulations, codes, and ordinances.

QUALITY ASSURANCE

Workmanship and neat appearance shall be as important as the mechanical and electrical efficiency of the system. All testing and clean-up shall be completed to the satisfaction of UNLV Network Development and Engineering before sign-off. This includes, but is not limited to, cable testing, proper labeling, debris removal, and proper cable bundling and routing.

Damage of Existing Facilities
The Contractors shall be responsible for replacing, restoring, or bringing to at least original condition any damage to floors, ceilings, walls, furniture, grounds, pavement, etc., caused by its personnel and operations. Any damage or disfiguration will be restored at the Contractor's expense.

Coordination
Contractor is responsible for insuring minimal disruption of existing television, telemetry, telephone and data communications facilities and networks.

Outages shall be scheduled only with permission from UNLV Network Development and Engineering at its convenience.

All work areas shall be cleared of all litter, and properly disposed of by Contractor on a daily basis.

At its own expense, Contractor shall erect temporary fencing where required or deemed necessary by University personnel, or where deemed necessary by the Contractor for securing materials.

Contractors shall provide all necessary temporary equipment and material, shall maintain them in a safe and adequate manner, and shall remove them immediately upon completion of work requiring their presence.

Cable Support and Anchors
All cables, wires and equipment will be firmly anchored. Fasteners and supports shall be adequate to support loads with ample safety factors.

Firestop Systems
A firestop system is comprised of an item or items penetrating a fire rated structure, the opening in the structure, the sealing materials, and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped using state approved fire resistant materials installed in accordance with the manufacturer's tested methods. All penetrations through fire rated surfaces shall comply with the following:

- ASTM E 84: Standard Test Methods for Surface Burning Characteristics of Building Materials

- ASTM E 119: Methods of Fire Tests of Building Construction Materials
- ASTM E 814: Standard Method of Fire Tests of Through-Penetration Firestops
- ASTM C 719: Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement
- ASTM C 920: Standard Specification of Elastomeric Joint Sealants
- UL 263: Fire Tests of Building Construction Materials
- UL 723: Surface Burning Characteristics of Building Materials
- UL 1479: Fire Tests of Through Penetration Firestops
- UL 2079: Standard for Fire Tests of Joint Systems

Conduit
Conduit shall be Electrical Metallic Tubing produced in accordance with ANSI C80.3 standard and run in the most direct route practical.

Conduit runs containing more than two 90-degree bends, or a reverse (180 degree) bend require a pull box.

All offsets shall be considered equivalent to a 90-degree bend.

Conduit bend radii will be a standard ten times the outside diameter of conduit unless otherwise approved by UNLV Network Development and Engineering.

Conduits entering the IDF through the wall shall be reamed or bushed, and terminated not more than 4 inches from the wall surface.

Conduits entering the IDF from below shall be terminated 4 inches above finished floor.

Conduit runs for distribution cables (both horizontal and vertical), except station outlets, shall be not less than 4" in diameter. They will be equipped with a plastic or nylon number 12 or larger pull line that is rated at 800-lb. test minimum.

Conduit installed for data and/or voice cabling may not be shared with any other cable.

All conduit runs for station outlets shall be not less than 3/4" in diameter. All conduit runs for station outlets with more than 3 cables shall be not less than 1" in diameter. They will be equipped with a plastic or nylon number 12 or larger pull line that is rated at 800-lb. test minimum.

After installation, all conduits shall be clean, dry, unobstructed, capped for protection and labeled with their destination (by room number) for identification.

Allowable fill capacity is 40% or as defined by the National Electric Code, whichever is lower.

Conduit runs for horizontal distribution cables, utilizing the trapeze hanger method to support the conduits, shall utilize threaded rods of not less than 3/8" in diameter.

Conduit shall not block access to existing services.

Cable Installation
All cable shall be installed free of kinks. A kink is defined as a violation of the manufacturer's specified Minimum Bend Radius for each type of cable. Cable shall not be formed into a condition that causes the outside sheath to wrinkle.

Any cable to be placed through an electrical room or any other potentially hazardous conditional shall be placed in conduit.

All cable will be secured to the backboard in such a manner as to allow cross connections to be made without crossing over any cables.

All outlets will have a minimum of eight (8) inches of cable stored at each drop after the cable has been terminated.

Where considerations of practicality eliminate the installation of conduit, plenum cable will be used. Cables are not permitted to lie atop a lay-in ceiling or simply drape over pipe and ductwork; appropriate wire hangers/supports or dressing will be used.

Cables are to be anchored to the wall extensions, existing conduits, pipe, or duct work in a neat manner.

Cable pulled in a cable tray with existing cable should not be pulled where stress would be applied to the existing cable.

All cable is to be terminated at both ends, tested, labeled and ready to provide service to and within the building.

Installation to meet or exceed ANSI/EIA/TIA 568B and ANSI/EIA/TIA 569. UNLV Network Development and Engineering must approve completed installation.

QUALITY CONTROL TESTING

Cable Testing
All cables and termination hardware shall be 100% tested for defects in installation and to verify cable performance under installed conditions. The contractor, prior to system acceptance, shall verify all conductors of each installed cable. Any defect in the cabling system installation including but not limited to cable, connectors, feed-through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% usable conductors in all cables installed.

Data Copper
All Data cables shall be tested in accordance with ANSI/TIA/EIA Category 6 Standard Performance Specifications for 4-Pair 250 Ohm Category 6 Cabling using TIA TSB-95 or better, and best industry practices. If any of these are in conflict, the Contractor shall be responsible to bring any discrepancies to the attention of UNLV Network Development and Engineering.

Testing
Each cable shall be tested for continuity on all pairs and/or conductors. Twisted-pair voice cables shall be tested for continuity, pair reversals, and shorts. Twisted-pair data cables shall be tested for all of the above requirements, plus tests that indicate installed cable performance. The data cables shall be bi-directional tested using a Class II-E or better cable analyzer.

Continuity
Each pair of each installed cable shall be tested for opens, shorts, polarity and pair-reversals. The test shall be recorded as pass/fail as indicated by the test set in accordance with the manufacturers recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

Length
Each installed cable shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the TIA/EIA-568-B Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multipair cables, the longest pair length shall be recorded as the length for the cable.

Performance Verification
Enhanced Category 6 data cable shall be performance verified using an automated test set. This test set shall be capable of testing for the continuity and length parameters defined above, and provide results for the following tests:
Near end crosstalk (NEXT), attenuation, ambient noise, and attenuation to crosstalk ratio (ACR).

Equipment
Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a
download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result and the actual test result achieved. All test results to be provided to UNLV Network Development and Engineering in .PDF and Linkware format prior to acceptance of completed project. All test results must be labeled with the specific data cable that was tested by its identifier on the patch panel.

Fiber Optic
Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. The test results shall include all tests performed, the expected test result and the actual test result achieved. All test results to be provided to the UNLV Network Development and Engineering in .PDF format prior to acceptance of completed project. All test results must be labeled with the specific data cable that was tested by its identifier on the patch panel.

Test evaluation for the panel to panel (backbone) shall be based on the values set forth in the EIA/TIA-568-B Annex H, Optical Fiber Link Performance Testing.

Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements.

The expected results for each cable (or group of cables of the same nominal length) shall be calculated before the start of testing and recorded in a space provided on the Contractor’s test matrix. Each strand of fiber in the respective cable shall be evaluated against this target number. Any fibers that exceed this number by more than -0.5dB shall be repaired or replaced at the installers' cost.

Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between UNLV Network Development and Engineering and the Contractor prior to the start of the test.

Multimode
All multimode optical fiber attenuation shall be measured at 850 nanometers (nm) and 1300 nm using an LED light source and power meter. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B. One 2-meter patch cord shall be used for the test reference and two 2-meter patch cords shall be used for the actual test. This test method uses a one-jumper reference, two-jumper test to estimate the actual link loss of the installed cables plus the loss of two connectors. This measurement is consistent with the loss that network equipment will see under normal installation and use. Test evaluation for the panel to panel (backbone) or panel to outlet (horizontal) shall be based on the values set forth in the EIA/TIA-568-A Annex H, Optical Fiber Link. Multimode fiber optic cable must meet or exceed the following limits:

1. Attenuation
   3.5dB/km at 850nm, 1.5dB/km at 1300nm.
2. Bandwidth
   1500MHz*km at 850nm, 500MHz*km at 1300nm.

3. Connectors
   Max loss for a mated pair of connectors shall be less than 0.5dB

Singlemode
Single mode optical fiber attenuation shall be measured at 1310 nm and 1550 nm using a laser light source and power meter. Tests shall be performed at both wavelengths in one direction on each strand of fiber. The set-up and test shall be performed in accordance with EIA/TIA-526-7 Standard, Method 1A. Two-meter patch cords shall be used as test references and for the actual test. This test method utilizes a one-jumper reference, two-jumper test to estimate the actual link loss of the install cable plus two patch cords. Singlemode fiber optic cable must meet or exceed the following limits:

1. Attenuation
   0.4dB/km at 1310nm, 0.3dB/km at 1550nm.
2. Connectors
   Max loss for a mated pair of connectors shall be less than 0.5dB

OTDR
Each cable shall be tested with an Optical Time Domain Reflectometer (OTDR) to verify installed cable length and splice losses. The OTDR measurements for length shall be performed in accordance with EIA/TIA-455-60. The measurements to determine splice loss shall be performed in accordance with manufacturer’s recommendations and best industry practices.

As-Builts
All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. The As-built drawings shall clearly identify the patch panel label and it's corresponding station side location. As-builts will be created from latest digital architectural drawings, to most closely resemble exact building conditions, as possible. Hand drawings are not acceptable. As-builts & test results must be provided in both .PDF and CAD format. Upon acceptance of contract, vendor will be required to provide an acceptable time-line for provision of As-Built drawings. Acceptable time-line shall be verified by UNLV Network Development and Engineering. Ample time must be allocated for verification of As-builts & test results and subsequent corrected versions of those documents. Network equipment (Including Voice, Data and A/V services) will not be provisioned until this documentation is provided.