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SECTION 01000

GENERAL REQUIREMENTS

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SECTION 01000

GENERAL REQUIREMENTS
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PART 1 GENERAL

1.1 SCOPE

Provide supervision, labor, equipment, tools, materials, and supplies to complete the Work per Work Order drawings and specifications, these general specifications, and the General Terms and Conditions.

1.2 FURNISHED DRAWINGS AND SPECIFICATIONS

- a. Five sets of full-size contract drawings and specifications will be furnished without charge. Other reference publications will not be furnished.
- b. Immediately check furnished drawings and specifications, and notify COTR of any discrepancies. Commencement of work shall constitute acceptance of drawings. Field check dimensions of existing facilities on drawings for accuracy and determine exact dimensions for proper fit.
- c. All design, drawings, and calculations shall be in English units.

1.3 SUBMITTALS

Submit the following per Section 01300, Submittals:

SD-09 Reports

Submit progress reports per Paragraph 3.5.B.

SD-20 Work Plan

Submit at or before the pre-construction conference or as requested by COTR.

1.4 HOURS OF WORK

Normal hours for construction work are from 7 a.m. to 5 p.m. Monday through Friday, excluding federal holidays. Requests for additional work hours require written approval in advance from COTR. Contractor's superintendent must be present during all after-hours work.

1.5 OCCUPANCY OF PREMISES

- a. The Government may occupy and use the facilities within and/or adjacent to the areas of Work during the entire construction period.
- b. Provide and coordinate controls for the abatement of dust, noise, and inconvenience to Government personnel during the Work. Arrange with COTR (before work is started) a sequence of Work, means of access, space for material and equipment storage, and use of approaches, corridors, and stairways. Obtain COTR approval at least three (3) days

in advance of starting any activity that will interfere with accessibility or normal work activities of occupants.

- c. Buildings undergoing construction, alteration, or demolition shall be in accordance with Article 87 of the California Fire Code (CFC) and NFPA 1, Chapter 16.

1.6 SECURITY

At all times while on government property, the Contractor, subcontractors, and their employees shall wear badges issued by NASA Security Office. Each individual will be required to sign personally for the badge. The Contractor will be held accountable for these badges and shall return them to the Contracting Officer immediately after completion of the work.

1.7 FINAL ACCEPTANCE

The Contracting Officer will conduct a pre-final inspection or test after the work is complete. Any discrepancies or uncompleted work will be noted and provided to the Contractor. Upon completion of the items, the Contracting Officer will conduct the final inspection or test before the building system is placed into post-construction operation and final payment is made.

PART 2 PRODUCTS

2.1 OPTIONS

The equipment, fixtures, materials, and other products that are specified on the drawings and equipment schedule by manufacturer and model number are those used for the design. Model numbers specified may not include all of the options specified by the manufacturer or required for the installation. Ensure that the products provided do include all options.

2.2 SUBSTITUTIONS

Contractor shall use the specified manufacturer's model(s), or an "equal" with the approval of the COTR. The characteristics that the COTR will use to determine whether a substitute is "equal" include the following:

- a. Performance type, type of construction, capacity, rating, and materials of manufacture, acceptance listing by industry standards organizations and/or national laboratories, and compatibility with existing systems equal to or exceeding those of the specified product.
- b. Size, mounting, appearance, and finish must be comparable to those of the specified model.
- c. Record of performance, ease of maintenance, manufacturer's warranty provisions, interchangeability of parts, and provision for modification or extension must equal or exceed those of the specified product, unless a request by the Contractor is approved by COTR for the reduction in these characteristics.
- d. If a substitute product is approved by COTR, the Contractor shall be responsible for modifying the design (approved by the COTR) of the system and/or supporting structure as required to accommodate the change, and for executing these modifications at Contractor's expense. Any difficulty or issue arising from the use of an approved

substitution shall be resolved by the Contractor to the satisfaction of COTR, at Contractor's expense.

PART 3 EXECUTION

3.1 TEMPORARY FACILITIES

- a. Install and maintain temporary utilities required for construction, and remove them upon completion of the Work. Materials, new or used, shall be adequate for their intended usage, and shall not create unsafe conditions nor violate applicable codes and standards. The Government will furnish required water and electricity (120 V/1 Ph). Connections, distribution, and lighting shall be furnished by the Contractor. Connection methods and locations must be approved in advance by the COTR.
- b. Provide and maintain temporary sanitary facilities, and remove them at the completion of the Work. Construction personnel shall not use existing facilities without COTR approval.
- c. Provide temporary fire protection equipment for the protection of personnel and property. Remove debris and flammable materials daily to minimize hazards.
- d. Provide signs necessary to expedite deliveries, maintain traffic flow, promote safety, and prevent interference with Government operations. Advertisement signs shall not be erected. Contractor shall obtain COTR approval of locations for placement of Contractor-owned or leased trailers and sheds, which shall be at least 30 feet from existing structures.

3.2 TRAFFIC PROVISIONS

Perform Work so as to minimize obstruction of traffic. Maintain traffic flow on at least half of the roadway width at all times. Obtain approval from COTR at least 72 hours in advance of starting any activity that will obstruct traffic. Provide, erect, and maintain lights, barriers, signals, passageways, detours, and other traffic-control items that may be required. Provide flag persons for traffic control when roadways are obstructed during normal working hours, and provide lighted barricades in appropriate locations at roadways obstructed beyond normal working hours.

3.3 PROTECTION OF EXISTING SYSTEMS

- a. Provide a clear record of existing conditions before starting work. This may include photographs or videotape.
- b. Provide temporary coverings to protect existing surfaces and equipment when Work is being performed in adjacent areas. Damaged surfaces and equipment shall be repaired or replaced, to the satisfaction of COTR and the Government, at the Contractor's expense.
- c. Protect existing utilities and safety systems from damage. Repair at Contractor's expense utilities and safety systems damaged by the Contractor.
- d. Immediately report to Inspector any utilities not previously identified to the Contractor when encountered in the field. The size, type, location, depth, and direction of these utilities shall be recorded on

the as-built drawings, and approved by Inspector prior to covering them.

- e. Structural members shall not be altered unless approved by COTR.
- f. Contact the Ames Fire Marshal/Fire Prevention Office prior to the building's existing fire protections systems and equipment being placed out of service or being restored to service.

3.4 UTILITY OUTAGES AND CONNECTIONS

- a. Schedule utility outages and connections required during the construction process at the convenience of the Government. Schedule Work to hold outages to a minimum. Submit a request to interrupt existing systems to COTR at least seven (7) days in advance.
- b. Take all reasonable steps to minimize the effect and duration of such interruptions.

3.5 PROGRESS CONTROLS

a. Project Meetings

1. Attend with all first tier subcontractors performing work on-site a pre-construction conference, if scheduled by the COTR. On-site work shall not commence prior to the conference. Discussion shall include introductions, project orientation, quality control, safety, environmental, administration and temporary utilities and facilities.
2. Participate in progress meetings, as scheduled by COTR. Discussion shall include submittals, progress, material delivery, potential delays, interfaces, problems, quality control, safety, and environmental.
3. Promptly report construction problems or design deficiencies encountered to COTR. Solutions will be determined by COTR.

b. Construction Schedule and Progress Reports

1. Contractor shall submit an original and subsequently updated schedule of Contractor activities and sequence of operations needed for the orderly performance and completion of the Work.
2. Contractor shall adhere to the schedule, and shall submit periodic progress reports and proposed schedule changes in the form and manner directed by COTR.

c. Project Closeout

1. Complete all required submittals and restore the site as required, including final cleaning.
2. Notify COTR in writing when Work is complete and ready for acceptance.
3. The COTR and Government will conduct reviews, inspections, and tests as needed to satisfy the COTR and Government that the Work conforms to requirements. The COTR will notify Contractor of any nonconformances.

4. Correct any nonconformances and then repeat the above acceptance procedure as required by the COTR and Government until the Work is accepted.
 5. Neither notice of acceptance nor final payment shall constitute waiver of Contractor's guarantee or warranty.
- d. Storm Water Pollution Prevention Program
1. The Contractor shall comply with ARC's Storm Water Pollution Prevention Program required by the Industrial Storm Water General Permit. This entails following the Best Management Practices (BMPs) developed to minimize the impact of industrial activities on storm water quality. Copies of any applicable BMPs can be obtained from the NASA Ames Environmental Services Office. Exterior storage of hazardous materials, exterior storage of hazardous waste, or any new construction are common activities that would be covered by a BMP including, but not limited to the following:
 - (a) Construction, Demolition and Excavation
 - (b) Erosion Control and Site Stabilization
 - (c) Good Housekeeping
 - (d) Material Handling and Storage
 - (e) Outdoor Process Equipment
 - (f) Overhead Coverage
 - (g) Repair, Remodeling and Construction
 - (h) Preventative Maintenance
 - (i) Secondary Containment
 - (j) Spill Response and Prevention
 - (k) Vehicle and Equipment Washing
 - (l) Waste Handling and Recycling
 2. If a proposed construction project disturbs less than 1 acre, storm drains located at the site must be protected and/or closed during any construction work. If a proposed construction project disturbs 1 or more acres of soil, or disturbs less than 1 acre but is part of a larger common plan of development that in total disturbs 1 or more acres, the Tenant is required to obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity. Please contact the NASA Ames Environmental Services Office for more information.

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SECTION 01100

SAFETY AND HEALTH
08/06

PART 1 GENERAL

1.1 SCOPE

This section applies to all construction work conducted at Ames Research Center under this contract, including all subcontract work.

1.2 REFERENCES

The publications listed below form a part of this section to the extent referenced.

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

Code of Federal Regulations Title 29, Parts 1926 and 1910.147

Protection of Environment, EPA

Code of Federal Regulations, Title 40

CAL-OSHA, Division of Industrial Safety, Title 8. Division 1, Chapter 4
Construction Safety Orders

California Code of Regulations, Title 26Toxics

BAY AREA AIR QUALITY MANAGEMENT DISTRICT (BAAQMD)

Regulation 11, Publication 1 Lead

SANTA CLARA COUNTY HEALTH DEPARTMENT

Hazardous Materials Storage Ordinance

Industrial Waste Ordinance, City of Mountain ViewProvision pertaining to
sewer service and sewage disposal

Water and Sewers, Title 12 City of Sunnyvale

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

APR 1700-1 (AUG 2005 J)Ames Health and Safety Manual

NASA STD 1740.9 (1991) Safety Standard for Lifting Devices
and Equipment

APR 8800.3 Ames Environmental Procedural Requirement

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z359.1 (1992) Safety Requirements for Personal

Fall Arrest Systems

ANSI A90.1	Safety Standard for Manlifts
ANSI A92.2	Standard for Vehicle Mounted Elevating and Rotating Work Platforms
ANSI B30.5	Safety Code for Crawler, Locomotive, and Truck Cranes

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910	Occupational Safety and Health Standards for General Industry
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241	(2000) Safeguarding Construction, Alteration and Demolition Operations
NFPA 30	(2000) Flammable and Combustible Liquids Code
NFPA 70	(1999) National Electrical Code

1.3 SUBMITTALS

Submit the following per Section 01300, Submittals:

[SD-06, Instructions](#)

[Material Safety Data Sheets](#) (MSDS's for chemicals to be used in the construction activities.

[SD-09, Reports](#)

[Safety Clearance Permit Requests](#), submit at least 24 hours in advance of covered work.

[Toolbox Safety Meeting Reports](#), submit weekly minutes of meetings, copy of attendee sign-in sheet and list of topics discussed.

[Accident Reports and Records](#), as required.

[Crane Inspection Reports](#), submit daily when operated.

[Confined Space Entry Permit](#), submit completed form daily including evaluations following space exit to Contracting Officer, Ames Safety Office, M/S 218-1.

[Crane Compliance Certification](#); submit for each crane 24 hours prior to bringing crane to Ames.

[Crane Lift Plans](#), submit at least 24 hours prior to lifting loads exceeding 75% of rated load capacity.

[Confined Space Training Certificates](#). Submit copies of training verification for entrants and attendants at least 48 hours prior to initial entry.

SD-20, Work Plan

Submit amendments or revisions to the General Safety Plan at least 10 days before the planned beginning of on-site work. This Safety Plan and any amendments shall be approved by COTR before such work may commence.

SD-20, Safety Plan

Submit Safety Plan and amendments or revisions at least 10 days before the planned beginning of on-site work.

SD-20, Activity Hazard Analysis (AHA)

Submit 48 hours prior to each major phase of work. Submit as amendment or revision to job-specific safety plan. AHA for preparatory phase of work shall be included with the initial Safety Plan.

1.4 DEFINITIONS

- a. Competent person. One who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees and who has authorization to take prompt corrective measures to eliminate them.
- b. Safety plan. The safety plan is one distinct part of the work plan. It includes hazard control details required by this section. An IIPP complying with 8 CCR 3202 is an acceptable equivalent, however the requirements in this section for a job-specific safety plan and site specific Activity Hazard Analyses must be provided additionally, prior to start of work.
- c. Job-specific safety plan. A detailed plan that describes anticipated potential hazards and planned controls for this particular project. It comprises the bulk of the safety plan and its specific contents are described in this section.
- d. Activity hazard analysis. A detailed analysis of potential hazards and planned controls for distinct phases of the work. These details are generally beyond the scope of the Job-specific safety plan but are necessary due to potential for significant mishap. Specific contents are described in this section.

1.5 GENERAL REQUIREMENTS

- a. Provide environmental, safety and health measures to insure a safe, healthy environment for employees, including those of subcontractors, and for other workers, bystanders and visitors in area of Contractor's operations.
- b. Comply with procedures prescribed by the Government for control and safety of visitors to the site.
- c. Familiarize employees and subcontractors with all safety and environmental requirements and enforce them.
- d. Advise COTR of any special safety restrictions established, so that Government personnel can be made aware of them.

- e. Require that superintendent give personal, on site attention to the Safety Plan while any work is in progress.
- f. New Employee Indoctrination. New employees shall be informed of specific site hazards before they begin work. Document in daily log.
- g. Training certificates: Contractor shall maintain a file of certificates for all training required by 29 CFR 1926 and 1910 as applicable for each person engaged in hazardous work. File shall be accessible and upon request made available to the Contracting Officer or appointed representative for review and verification for quality control purposes.
- h. Contractor shall avail Contracting Officer or appointed representative access to contractor's activities to determine adequacy of hazard prevention measures. Contractor shall also provide access for NASA Headquarters and Center safety, and environmental program review teams to conduct selected announced and unannounced reviews of contract operations.
- i. Contractor is responsible for safety requirements compliance by all subcontractors at every tier. All subcontracts pursuant to this contract shall include safety and environmental requirements of this section.
- j. Work requiring confined space entry shall be performed only by contractor's having one year or more experience in similar work. Contractor shall have an implemented confined space program based on a written procedures and responsibilities for testing, entry, permitting, evaluating, hazard control, rescue, qualifications and training.
- k. Notify the COTR and Ames Safety Office immediately upon discovery that OSHA or other regulatory agency is conducting an inspection of the job site.

1.6 EMERGENCY PHONES

Post emergency phone numbers at the jobsite. Report all emergencies and spills or releases of hazardous materials by dialing 911 on Government phones, or (650)604-5555 on other phones. Ambulance, fire, and police services are available through this number, 24 hours a day.

1.7 FIRST AID FACILITIES

The Ames Health Unit is located on the West end of building N215, on Durand Road, across the street from the north side of the cafeteria. It is open Monday through Friday, between 7:30 a.m. and 4:30 p.m., for emergency care.

1.8 NON-COMPLIANCE

COTR may, at any time, notify the Contractor, in writing, of any non-compliance with the provisions of this section, and may specify corrective actions to be taken. Contractor shall, upon receipt of such notice, immediately take corrective action and report to COTR corrections completed.

PART 2 SPECIFIC REQUIREMENTS

2.1 SAFETY PLAN

Submit a Safety Plan to COTR for approval before proceeding with any site work. This Safety Plan shall include as a minimum, the following:

- a. Code of safe practices, complying with 8 CCR 1509. This must be posted at job site.
- b. Identify detailed contractual and supervisory means for controlling and coordinating safety responsibilities and activities of subcontractors and suppliers in accordance with this section.
- c. Job-specific Safety Plan. Address each of the following. Indicate for each item 4 through 10 if separate AHA will be provided.
 1. Designated responsibilities of contractor's key personnel. Include names, safety qualifications and assignment details for controlling hazards on job site. Indicate name and professional certifications of the point of contact person responsible for safety on the site. This person must have adequate control of resources to abate hazards or stop work. Other key functions requiring responsible persons include reports and logs, exposure data monitoring, accident investigator and reporting. List training certifications required by 29 CFR 1926 and 1910 as applicable for designated key site personnel.
 2. Include a list of safety clearance permits that will be required and a simple table listing anticipated hazards and control measures.
 3. Safety meetings, inspections, and reports to be conducted or made.
 4. Demolition plan.
 5. Excavation plan.
 6. Hazardous energy control plan.
 7. Material and personnel lifting plan.
 8. Fall protection plan.
 9. Confined space plan. Identify the qualified person(s), training and experience. Delineate authority to direct work stoppage. Include procedure for rescue.
 10. Asbestos and lead control plan. Incorporate by reference other specialized job specific safety plans required by this contract such as asbestos removal if applicable.
 11. Other potentially hazardous tasks related to scaffolding, machinery, operational equipment, or electrical hazards.
 12. Hazardous materials use. Provision for secondary containment of any liquid hazardous material that will be brought on site. Inventory of materials to be introduced to site. Plan for personnel protection during transport, storage and use including

MSDS, labeling and hazard communications plan. Emergency spill plan.

13. Emergency response plan. Location, telephone numbers of emergency services and location of their posting on the job site. Procedures for securing an accident site until investigation by the government is complete. Procedures for securing work areas and protecting personnel in event of an accident or emergency. Accident reporting procedures.
 14. Alcohol and drug control plan.
 15. Unusual conditions. Power outage and weather contingencies.
 16. Identify AHA's anticipated in course of work.
 17. Hearing Conservation Program.
- d. Safety meetings, inspections, and reports to be conducted or made.
 - e. Location/telephone numbers of emergency services and location of their posting on the job site.
 - f. Accident reporting procedures.
 - g. Procedures for securing an accident site until investigation by the government is complete.
 - h. Procedures for securing work areas and protecting personnel in event of an accident or emergency.
 - i. Provision for secondary containment of any hazardous materials that will be brought on site.
 - j. Job-specific safety plans shall include a list of safety clearances that will be required, and a tabulation of anticipated hazards and measures to be used to control the respective risks to acceptable levels.
 - k. Activity Hazard Analysis for each major phase of work. Submit as modification to safety plan prior to start of work sequence. As a minimum these shall include: preparatory, excavation, erection and roof work phases of construction.

2.2 SAFETY CLEARANCE PERMITS

- a. A specific, written permit is required before conducting operations involving any of the dangerous operations listed below. Contractor shall insure that no such work is conducted prior to obtaining the permit, and that all provisions of the permit requirements are met. Contact COTR at least 24 hours in advance to obtain the required permit. Ensure person(s) is named and designated as competent person(s) and that qualifications and training are included in the Job-specific safety plan or AHA.
- b. The granting of a permit in no way relieves the Contractor of responsibility for any injury or damage that might result from his operation. Contractor shall comply with these requirements and with the fire protection, electrical and construction site safeguarding

requirements of [NFPA 241](#), sections 5 to 11 at contractor's expense.

1. OPEN FLAME HEATING DEVICES or OPEN FIRES. Use of these devices requires a permit. Burning of trash, brush, or wood is prohibited.
 2. EXCAVATION. Excavation [6 in.](#) or more beneath the surface requires a permit. Underground high voltage must be de-energized prior to pneumatic or machine powered excavation or subsurface demolition activities in vicinity. Obtain underground ground penetrating radar, sonar, or equivalent scanning type survey to locate and mark ground for all buried utilities and electrical conduits whenever high voltage is suspected to be near planned digging.
 3. CONFINED SPACE ENTRY. Entry or work in confined spaces, including but not limited to manholes and vaults, requires a permit. Provide training certificates for attendant, entrant(s) and rescue personnel at time of request for safety clearance permit.
 4. FACILITY CLOSURE OR OBSTRUCTION. Obstruction of streets, walks, and parking areas, and other facilities occupied and used by the Government requires a permit.
 5. ELECTRICAL WORK. Work on live 480 V. parts is generally prohibited. When impractical to de-energize, work on electrical circuits or equipment of 480 V. or greater requires a safety clearance permit and compliance with special provisions of [APR 1700.1](#), Section 11.
 6. WELDING, FLAME CUTTING, AND MELTING. These operations, when performed in an existing or occupied facility, require a permit.
 7. CRANE LIFTS. Permits are required for lifting loads greater than 75% of rated capacity. Provide a lift plan at time of request for safety clearance permit.
- c. Crane Compliance Certification. Provide for each crane entering Ames under this contract. Provide statement on company letterhead indicating that crane and rigging gear meet [29 CFR 1926.555](#), 952(c), and 406(a) requirements as applicable. Include operator training and qualification data.

2.3 HOLD OFF AND SPECIAL CONDITIONS TAGS

- a. HOLD OFF DANGER: DO NOT OPERATE and SPECIAL CONDITIONS CAUTION tags are in general use on the site. They are used whenever equipment lockout or use only under specific, limited conditions is required for a safe working environment. Contractor is required to ALWAYS HONOR THESE TAGS. If Contractor needs to have a tag removed or believes that one should be applied, it shall coordinate with the person who originally signed the tag to effect the application or removal.
- b. A HOLD OFF tag constitutes an order not to operate a piece of equipment. This tag shall be used only during performance of maintenance or repair work on equipment. This tag shall be used in conjunction with lock out.
- c. A SPECIAL CONDITIONS tag specifies the conditions or circumstances under which the equipment may be operated. It constitutes an order not to operate the equipment except under the conditions or circumstances

specified. This tag may be used for extended shut down of equipment or circuits when used in conjunction with lock out.

2.4 REPORTS AND RECORDS

- a. Require superintendent to conduct weekly toolbox safety meetings with all Contractor and Subcontractor employees, and maintain copy of the minutes of these meetings in the project file.
- b. Immediately make an oral report to COTR of any accident that results in one of the following: fatality; disabling or lost-time injury; injury requiring medical treatment; property contamination; or property loss of \$10,000 or more. Submit a completed NASA Form 1627 within 24 hours of any accident. Submit a written report to COTR within 5 days of each incident, including investigative findings (but is not required to include an expression of opinion as to the negligence or fault of any employee) and proposed or completed corrective actions.
- c. Maintain a log of safety inspections conducted, employee requests for inspections and verbal reprimands made to employees for safety violations.

2.5 SAFETY INSPECTION

The Contractor's on-site operations are always subject to inspection by the Government's construction safety engineer and by other inspectors. Contractor shall comply with reasonable requests of these individuals, as relates to safety. Contractor shall notify COTR if Contractor believes a change to the project Work is required.

2.6 FALL PROTECTION ANCHORAGE

Personal fall arrest anchorages shall be installed in accordance with ANSI Z359.1 requirements. Permanent anchorages installed under this contract shall remain in place for continued government use. Provide standard primer sealer and finish paint if not galvanized, for corrosion protection purposes.

2.7 PERMANENT SIGNAGE

Provide permanent warning and identification signs in accordance with 29 CFR 1910 and NFPA 70 requirements for potential hazards installed under this contract. These shall include but not be limited to circuit breaker identification, high voltage electrical warning, pipe labeling and confined space warnings. On new permit required confined spaces, labeling signs shall be integral to or securely attached weather resistant signs on access covers. Coordinate with Contracting Officer for approval of signs differing from similar existing signs installed throughout Ames.

2.8 CHEMICALS AND HAZARDOUS MATERIALS

Chemicals and hazardous materials as defined in 29 CFR 1910.1200 that are integral to new work and remain part and parcel to completed work installed, shall be identified by the contractor. Products containing carcinogens as defined in 29 CFR 1910 Subpart Z or by the State of California shall be approved by the Contracting Officer. Sheet rock and gypsum wallboard products shall be asbestos free. This is intended to restrict certain gypsum products available in the U.S. but manufactured in whole or in part without voluntary manufacturer's asbestos free guidelines

and not otherwise regulated in the General Provisions, Buy America clause.

2.9 LIFTING DEVICES

In addition to other requirements specified in this contract, permanently installed lifting devices and associated equipment shall comply with the design safety requirements of the NASA Safety Standard for Lifting Devices and Equipment, NSS/GO-1740.9B.

2.10 HIGH NOISE LEVEL PROTECTION

Ensure that employees in high noise areas (>85 dBA) use hearing protection devices. Ensure that employees exposed to an 8-hr. time weighted average of 80 dBA measured with a dosimeter or sound level meter participate in a hearing conservation program. Develop a hearing conservation program for employees, as necessary, to include annual hearing conservation training, baseline and annual audiometric testing, and proper hearing protection in accordance with [APR 1700.1](#) Chapter 29, Hearing Conservation Program.

PART 3 EXECUTION

3.1 GENERAL SAFETY RULES

- a. Follow the following safety rules in addition to the requirements of federal OSHA, Cal/OSHA, and other laws and regulations.
- b. Maintain the work area in a clean and tidy condition at all times. Remove debris and rubbish from the site daily or place in an approved dumpster, provided by the Contractor and removed as required. Keep emergency access and egress routes clear at all times.
- c. Tie off and/or brace ladders to prevent movement. Do not permit workers to stand on any of the top three rungs of a stepladder.
- d. Require employees to wear approved hard hats at all times in designated hard hat areas.
- e. Raise and lower all tools and equipment by means of a bucket and/or rope. Do not permit employees to throw or drop items from one level to another.
- f. Require all employees to use safety clothing and equipment appropriate to the work they are performing. Provide all necessary safety clothing and equipment, including: goggles or face shields, protective garments, ear protection, safety shoes, and safety belts. Train all employees in the proper use of these items. Insure that persons employed in cutting, chipping, burning, and similar operations use proper eye protection.

3.2 FIRE PREVENTION AND PROTECTION

- a. Store and handle flammable and combustible liquids in accordance with Article 79 of the California Fire Code (CFC) and [NFPA 1](#), Chapter 60.
- b. Prohibit smoking in buildings and in dangerous areas, such as paint storage, fuel storage, confined space, and posted "No Smoking" areas.
- c. Provide obstruction-free routing for persons carrying hot substances. Hot substances shall not be carried up or down ladders.

- d. Store and handle flammable compressed gasses in accordance with Article 80 of the California Fire Code (CFC and NFPA 1, Chapter 63).
- e. Provide, maintain, and make available at the site, a minimum of two portable fire extinguishers. For welding and torch-cutting work, these shall be in the immediate vicinity of the work.
- f. Prohibit open fires or salamanders in construction areas.
- g. Maintain building/structure means of egress in accordance with Article 12 of the California Fire Code (CFC) and NFPA 1, Chapter 4.
- h. Maintain existing fire protection systems and equipment in an operable condition at all times.
- i. Familiarize employees and subcontractors with the buildings/structure's evacuation plan.
- j. Report, without delay, the occurrence of a fire or medical emergency, the release of flammable or hazardous materials, or similar conditions to the Ames Fire Department.

3.3 EXCAVATION

- a. Obtain from COTR prior to any excavation the locations of the underground utilities in the area and mark these locations on the ground surface. The elevations and exact locations of all utilities are not known; therefore, exercise caution in all excavation work to avoid damaging existing utilities.
- b. Conduct all excavation under the direct, on-site supervision of a qualified person with experience in earthwork and knowledgeable of the requirements of Article 6 of the California Construction Safety Orders. This person shall be named on the Excavation Permit Request. The competent person shall inspect the excavation daily and after every rainstorm or other hazard-increasing occurrence, before any person is allowed to enter the excavation. If inspection reveals a potential hazard, it shall be mitigated before any person is allowed to enter the excavation. Keep a log of these inspections and submit a copy to COTR with each weekly tool-box meeting minutes.
- c. Shore all excavations 5ft or more in depth. Shoring shall meet the requirements of OSHA (29 CFR 1926.652(c)). Shoring for excavations over 12 ft in depth shall be designed by a California registered Civil Engineer, and design shall be submitted to COTR for approval.
- d. When work is being done in trenches deeper than 4 ft, provide ladders or other safe means of egress in the trench, so as to require no more than 25 ft of lateral travel for employees; and provide at least one Contractor employee to stand by above ground, ready to give assistance in an emergency.
- e. Barricade open trenches and excavations to comply with regulations and to the satisfaction of COTR. "Sawhorse" barricades and warning tape do NOT constitute an acceptable barricade. Provide and maintain warning lights at night, and signs. In addition, use safety cones and warning flags to direct traffic around such openings.

3.4 CONFINED SPACE WORK

- a. If entry into confined space(s) is required, implement a confined space entry program compliant with applicable regulations (the federal OSHA confined spaces standard applies in areas of federal jurisdiction, which is most of the Center; the CAL-OSHA confined spaces standard applies for spaces north of Hunsaker Road and west of Lindbergh Road).
- b. Confined spaces are those that have extremely limited provisions for entry and exit, have poor natural ventilation, or contain or may contain hazardous atmosphere.
- c. Blind, block or disconnect all pipelines that may contain flammable or hazardous substances and that enter a confined space, before entry.
- d. If tests determine that hazardous conditions exist, remove all hazardous substances, and/or provide ventilation to the satisfaction of Safety Engineer prior to entry.
- e. When oxygen-consuming or hazardous-substance-producing procedures are to be employed in the confined space, or when the Safety Engineer determines that a hazardous atmosphere may develop during work, provide a qualified person and adequate testing devices to monitor air quality during the entire work period, at Contractor's expense.
- f. Provide at least one employee to stand by outside of the confined space, ready to give assistance in an emergency. When open manholes or vaults are barricaded, provide warning lights at night, and signs. Place rescue and retrieval body lifting device in a ready position above spaces greater than 5 ft in depth.
- g. Whenever it is necessary to work in an area equipped with an automatic CO2 discharge system, lock closed and tag the CO2 isolation valve before entering the area. An audible alarm shall precede the activation of the CO2 discharge system. When the alarm sounds, all personnel shall leave the area immediately. Do not re-enter the area without proper breathing apparatus unless gas detection tests have been made and the area declared safe.
- h. Other specific requirements for confined space work include:
 1. Use manhole cover hooks, cover lifters, or recessed handles for removing or replacing manhole covers.
 2. Enter and exit manholes by means of a ladder whenever possible. Manhole covers and gratings shall be properly seated when replaced.
 3. Use only NEC-approved lighting units for illumination when working in confined spaces.
 4. Prohibit matches and smoking in confined spaces.
 5. Ground all air-driven tools used around energized cables.
 6. Return expired entry permits and exit evaluations to Contracting Officer, Ames Safety Office, M/S 218-1.

3.5 FACILITY CLOSURE OR OBSTRUCTION

Adequately barricade any closure or obstruction of streets, walks or other facilities that provide and maintain warning signs and lights (at night). Ensure that the closure or obstruction is of the minimum practical duration.

3.6 ELECTRICAL SAFETY

- a. Before maintaining, repairing, or performing any work on any electrical equipment or system, it shall be disconnected from the power source, locked/tagged out, and tested. Properly ground any electrical equipment or circuit before working on it. Unless prior approval has been given by COTR, it shall be disconnected from the power source.
- b. Protect portable electric tools with standard 3-prong grounding plugs or use double-insulated tools. Unplug tools when not in use.
- c. Use ground fault interrupters on all temporary electrical lines and cables. Route temporary wiring and cables to prevent tripping hazards and protect from damage.
- d. When permanently removing equipment or circuits, the wiring, conduit, and boxes shall be removed back to the source, unless otherwise specified.

3.7 WELDING, FLAME CUTTING, AND MELTING

Provide protection during flame cutting and welding to prevent splatter from damaging facilities or causing fire. When these operations are performed above or below ground level, provide at least one employee to stand by at the ground with firefighting equipment, ready to give assistance in an emergency.

3.8 RADIATION FOR NONDESTRUCTIVE TESTING

- a. Use of radioactive materials, radiation producing machines, or particle accelerator equipment is not allowed on-site, UNLESS written authorization has been obtained from the NASA Radiation Safety Officer. Ames Research Center is a federal site under the jurisdiction of the Nuclear Regulatory Commission (NRC).
- b. All non-NRC licensed radiographers shall obtain a reciprocity agreement with the NRC prior to bringing sources on site. A copy of the radiography contractor's license to conduct radiography and its company safety manual shall be kept on file with the NASA Radiation Safety Officer.
- c. Conduct permitted radiation operations only under the surveillance of a NASA representative. Conspicuously post the area and erect barriers, as required by Title 10, Code of Federal Regulations, Part 34.42. During hours of darkness, the signs shall be conspicuously illuminated with an amber or white light. Maintain direct surveillance of the area to protect against unauthorized entry. Maintain a properly calibrated survey meter on site and conduct periodic monitoring.
- d. Unless otherwise specified, non-destructive testing shall be in accordance with MIL-STD-271, modified by deletion of all reference to Bureau of Ships and other Navy agencies and substitution of NASA therefor. Radiographs shall be performed in a manner consistent with

Title 10, CFR and approved by the COTR, and in the presence of an approved radiographer. Radiography shall normally be required to be performed outside of normal working hours. Immediately report to the RSO any loss of radioactive material or any radiological health hazard or emergency. Upon completion of radiological operations, notify the RSO and remove warning signs and ropes.

- e. Conduct any photoprocessing of radiographic film per the requirements of the City of Mountain View or the City of Sunnyvale. The Radiation Safety Permit Request shall contain an annotation of the volume of waste water anticipated to be discharged and the location of proposed discharge. If the permit request is not so annotated, the Contractor shall NOT perform on-site photoprocessing.

3.9 EXPLOSIVES

Explosives shall not be used or stored on site.

3.10 ASBESTOS

- a. Unless otherwise specified, no asbestos-containing materials are to be used by the Contractor.
- b. All materials to be encountered on the site may contain asbestos unless specifically identified otherwise. If unspecified material is encountered, immediately inform the COTR. Do not break, burn, or disturb any materials containing asbestos. If COTR determines it necessary, arrange for removal, disposal, and/or isolation of the material. Perform such work for the lowest cost while meeting regulatory requirements.
- c. Handle asbestos-containing materials as specified in Section 02080, Asbestos Abatement.
- d. Specifically address asbestos in Safety Plan and discuss the operations and precautions planned to mitigate worker exposure to the fibers.

3.11 LEAD

- a. Existing painted structural and miscellaneous steel and steel pipe shall be assumed to be coated with lead-based material, unless otherwise specified. All requirements for lead-containing materials and lead-producing operations, contained in the referenced regulations shall be met, as shall the additional requirements below.
- b. Demolition and abatement of lead-based paint shall be performed as specified in Section 02090.
- c. Burning or welding through lead-based paint is prohibited. Vacuum-blasting operations is permitted, provided that the operator wears approved respiratory protection. General blasting shall be contained to prevent lead levels in excess of the General Industry standard outside of the containment. Ground level concentrations of lead outside of the immediate work area shall not exceed the limit specified by the Bay Area Air Quality Management District (BAAQMD) in Regulation 11, Publication 1, Lead.
- d. The Government may elect to conduct air monitoring to assure itself that the Contractor is complying with the requirements of Cal-OSHA,

federal OSHA, and BAAQMD. This testing shall not relieve the Contractor of any of the employer's responsibilities under these regulations. If requested by the Government, the Contractor shall allow its personnel to wear air-sampling devices (provided by the Government), at Contractor's expense. If Government testing/monitoring shows non-compliance with regulatory requirements, the Contractor shall alter its work procedures/personnel protections so as to come into compliance, at Contractor's expense.

- e. Blasting material (including water from water-blasting) shall be contained, removed from the surroundings, and disposed of in accordance with the characterization results. Contractor shall provide testing and certification by an independent testing agency that demonstrates that it is not classified as hazardous.

3.12 PRESSURE SYSTEMS

Work on systems designed for gas pressures above 140 psi or liquid pressures above 80 psi, is subject to special provisions of [APR 1700-1](#), in addition to those of this section.

3.13 POLLUTION PREVENTION

- a. Contractor shall ensure that construction, demolition, and excavation practices do not cause pollutant discharges on Ames Research Center and Moffett Federal Airfield.
 - 1. Staging Area - The Staging Area, to the maximum extent practicable, shall not be located near catch basins, gutters, drainage ditches, and creeks. Routine inspection of the jobsites shall be performed periodically to ensure that construction, demolition, and excavation materials (liquid or solid) are not entering the storm drain system or causing pollution. The jobsite shall be kept orderly. Storm drain catch basins shall be covered to prevent pollutants and sediments from entering the storm drain system. Scrap, debris, and nonhazardous waste material shall be collected and disposed of properly.
 - 2. Street Sweeping/Catchbasins - Roadways and on-site paved areas involved in or impacted by the project shall be cleaned and swept daily. Use of water to flush down streets in place of street sweeping is prohibited. Catch basins impacted by the project shall be inspected and vacuumed, if necessary, at project completion.
 - 3. Dumpsters/Bin - Dumpsters shall be periodically inspected for leaks. Leaking dumpsters shall be replaced or repaired. Discharging water on-site from cleaning dumpsters is prohibited. Waste collection shall be scheduled before the dumpster overflows.
 - 4. Hazardous Material/Waste Storage - Hazardous materials such as pesticides, paints, thinners, solvents, and fuels; and hazardous wastes such as waste oil and antifreeze; shall be labeled and stored in secondary containment in accordance with the Santa Clara County Hazardous Materials Storage Ordinance and applicable State and Federal regulations. These hazardous materials and hazardous wastes shall be covered wherever practicable.
- b. An accurate inventory of hazardous materials and hazardous wastes,

including Material Safety Data Sheets (MSDSs), shall be maintained to assist emergency response personnel in the event of a hazardous materials incident.

1. Usage - The manufacturer's instructions regarding uses, application, protective equipment, ventilation, safety precautions, and mixing of chemicals shall be followed.
2. Disposal - Hazardous wastes generated by the project, including light ballasts, shall be handled and managed properly. Contractor shall transfer hazardous wastes to a designated location at the Center for disposal by the Government.
3. Spill Prevention and Control - Spill cleanup materials (such as rags or absorbents) shall be maintained and be readily accessible. Releases shall be immediately contained and measures implemented to prevent leaks and spills from entering storm drains. Releases are prohibited from being washed into streets, gutters, and storm drains. Releases shall be reported to COTR and Ames Codes QH, and QE.
4. Contractor Training and Awareness - Employees/subcontractors shall be trained on the pollution prevention requirements contained in these specifications. The Contractor shall inform subcontractors of the pollution prevention contract requirements, and shall include appropriate subcontract provisions to ensure that these requirements are met.
5. Painting - Painting products shall conform to Regional Air District (BAAQMD) Rule 8 for VOC contents. Before project commencement, Material Safety Data Sheets shall be submitted to Ames Code QH/QE for review and approval of the products to be used. Solvent usage shall be monitored, and the amounts used shall be reported to Ames Code QH/QE.
 - a) Water-Based Paint - Remove as much excess paint as possible from brushes, rollers, and equipment before starting cleanup. To the maximum extent practicable, measures shall be implemented to dispose of wash water from aqueous cleaning of equipment and tools to the sanitary sewer. Otherwise, cleaning of painting equipment and tools shall be conducted in a designated area that will not allow run-on of stormwater or runoff of spills. The rinsate shall be containerized for subsequent discharge. Cleaning equipment, vehicles, or tools over catch basins, into streets, gutters, storm drains, or creeks is prohibited. Dispose of dry, empty paint cans/buckets, old dry brushes, dry rollers, dry rags, and dry drop cloths in the trash.
 - b) Oil-Based Paint - Remove as much excess paint as possible from brushes, rollers, and equipment before starting cleanup. To the maximum extent practicable, filter paint thinner and solvents for reuse. Dispose of waste thinner and solvent, and sludge from cleaning of equipment and tools as a Hazardous Waste. Dispose of dry, empty paint cans/buckets in the trash. Discarded items including material containers, old brushes, rollers, rags, and drop cloths shall be disposed of as a hazardous waste if they are heavily contaminated.

3.14 LIFTING

- a. Personnel Lifts. Occupied scissor lifts shall be lowered prior to horizontal relocation. Hard hats shall be worn while in lifts. Personal fall restraint devices shall be utilized. Personnel lifting shall comply with ANSI A90.1 and A92.2.
- b. Materials Lifting. Comply with rigging requirements of ANSI B30.5 and APR 1700.1 sections 17.4.5 to 17.8. Tandem lifting is prohibited. Each load shall be rigged and attached independently to the hook or master-link in such a fashion that the load cannot slide or otherwise become detached. Lifting of multiple rigged materials on a single hook or master-link, also known as Christmas-tree lifting or tandem lifting is prohibited.
- c. Loads shall not be positioned above occupied buildings or within 10 ft of windows in occupied buildings.

3.15 DEMOLITION

Avoid production of dust during concrete demolition. Wet concrete before demolition. If dust is visible from concrete demolition, provide additional wetting of concrete. Concrete cutting waters must not enter storm drain.

-- End of Section --

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SECTION 01300

SUBMITTALS

08/06

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- 1.4 REVIEW AND DISPOSITION

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section Table of Contents --

SECTION 01300

SUBMITTALS

08/06

PART 1 GENERAL

1.1 SCOPE

- a. This Section applies to all Work done under this Contract.
- b. Submittals (SD) are drawings, diagrams, schematics, descriptive literature, illustrations, schedules, performance and test data, samples, and similar materials that are to be furnished by the Contractor. Submittals explain in detail the manner in which the Contractor will conduct specific portions of the Work.

1.2 SUBMITTALS

- a. At or before the preconstruction conference, or as requested by the COTR, Contractor shall provide a list of required submittals, including for each submittal the "SD" number and identifying title of the submittal, the Contractor's scheduled date of submittal, and need date for any related COTR approval to proceed.
- b. Submittals shall use English units.
- c. Submittals shall be provided by the Contractor, and shall not be submitted directly by lower-tier subcontractors.
- d. The following are descriptions of submittals.
 1. Those marked with a plus (+) are required; those marked with an additional plus (++) require COTR's approval to proceed prior to ordering affected product(s) or proceeding with the affected work, unless specified otherwise on the drawings or in the design package.
 2. Those marked with an asterisk (*) are required only if specifically requested on the project drawings or in the design package, which will identify the materials/products to which the required submittals apply. Those marked with an additional asterisk (**) require COTR's approval to proceed prior to ordering the affected product(s) or proceeding with the affected work, unless specified otherwise.
 3. Others shall be submitted only if they are pertinent to the scope of the Work (per the technical sections of these specifications), and COTR's approval to proceed is not required for these, unless specified otherwise.
- e. **SD-01, Data - Calculations, descriptions, or other documentation regarding the work.
- f. **SD-02, Manufacturer's Catalog Data - Catalog cuts, brochures,

circulars, specifications, and printed information in sufficient detail and scope to verify compliance with contract requirements. This includes color charts displaying the complete range of the manufacturer's standard color and finish selections.

g. SD-04, Drawings

1. **Shop Drawings - Scaled drawings, schematics, and diagrams illustrating details, configuration, components, or function of a part of the work and/or connections or relationships among various parts of the work.
2. +As-Built Drawings - Complete set of contract and shop drawings that provide current factual information including deviations from, and amendments to the drawings and changes in the Work, concealed and visible. Lines, letters, and details shall be sharp, clear, legible, and drawn to the original scale. Submit one set of full size prints with alterations shown in red. Submit circuit panel schedules and one-line electrical drawings according to Section 16000, PART 1, 1.3 SD-04, As-Built Drawings.

h. SD-05, Design Analysis and Calculations

1. **Engineering analyses and calculations that verify that the individual end items meet contract requirements. Unless otherwise specified, these shall be performed and stamped by a Professional Engineer licensed in California.
2. **Mix designs for each type of concrete, grout, asphalt concrete, or blended material including a complete list of ingredients and admixtures; and applicable test reports verifying that the mix meets contract requirements.
3. **Equipment Performance Data providing information on use life, system functional flows, safety features, mechanical automated details, automatic interlocks, and such features as electrical system protective device ratings. Curves indicating tested and certified equipment response and performance characteristics.

i. *SD-06, Instructions - Standard, printed instructions for installation and use of the product(s), safety precautions, and Material Safety Data Sheets for chemicals to be used in the construction activities.

j. *SD-07, Schedules - Schedules of materials, equipment, and fixtures to be incorporated in the Work. These lists shall include manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site.

k. **SD-08, Records - A document required of the Contractor, or the manufacturer of a product, documenting procedures, qualifications, or other verification of quality.

l. SD-09, Reports

1. +Progress Reports, per Section 01000
2. +Safety Reports, per Section 01100

m. SD-10, Test Reports - Certified reports of inspections and tests,

including analysis and interpretation of test results, test methods used, and compliance with recognized test standards.

- n. SD-13, Certificates of Compliance - Supplier's or manufacturer's statement that the supplied product meets specified requirements, signed by an official authorized to certify in behalf of supplier or manufacturer, and identifying quantity and date of shipment to which the certificates apply. Certificates are not required if the submitted Catalog Data certifies the material as meeting the specification, or if the manufacturer affixes a label or other marking to the product that certifies this.
- o. SD-14, Samples
 - 1. **Product samples - Full-sized, complete examples of the manufactured product proposed for use, fully fabricated, with the specified finish. Provide the full set of available choices for selection of color, finish, and texture.
 - 2. **Material samples - Representative samples of construction materials proposed for use on the project, in quantities sufficient to perform the specified laboratory tests.
- p. +SD-18, Record of Existing Conditions - Record of Contractor's survey of work area conditions and features of existing structures and facilities within and adjacent to the jobsite; including the location and extent of any cracks or other damage and a description of surface conditions existing prior to start of Work. This may take the form of photographs or videotape. It shall be made by the Contractor and submitted before beginning on-site work.
- q. ++SD-19, Operation and Maintenance Manuals - Bound sets of instructions and data, grouped by technical sections, including manufacturer's brochures, schematics, operating instructions and procedures, operating limits, safety precautions, preventive maintenance requirements and procedures, repair procedures, special tools list, and repair parts list.
- r. SD-20, Work Plan
 - 1. ++Safety Plan - Detailed procedures defining the Contractor's provisions for accident prevention and health protection of its workers, subcontractors, and government workers, and describing actions taken in case of accident. Per Section 01100, Part 2.1, job-specific safety plans shall include a list of required safety clearance permits and a tabulation of anticipated hazards and mitigation methods, and all of these materials shall be submitted with the Construction Plan.
 - 2. ++Construction Plan - Detailed procedures defining the precise manner in which the Contractor intends to perform construction activity, including equipment and techniques used and protection and controls.
 - 3. ++Environmental Protection Plan - Detailed procedures defining the Contractor's provisions for environmental protection and demonstrating an understanding of the environmental impacts from proposed activities. Included in the plan shall be mention of all hazardous materials planned for use (i.e., coatings, paints,

sealants, adhesives, solvents, etc) and a list of all applicable storm water Best Management Practices (BMPs). Details of specific product information may be submitted to Code QE at a later date, if not yet known. Sufficient detail shall be shown to allow Government review and concurrence of the proposed protective measures necessary to prevent contamination to the air, ground, and water. Of particular concern is protection of storm drains, minimization of waste (i.e., maximizing metals recycling), and minimizing dust emission from construction/demolition activities. This Environmental Protection Plan shall be submitted with the Construction Plan.

4. ++Quality Control Plan - Contractor's detailed procedures, instructions, and reports to be used to assure compliance with the contract, including a listing of outside testing agencies and engineers to be employed by the Contractor. This plan must include provision for: purchase control and receiving inspections, control/disposition of non-conforming work, inspection/ test plans and procedures, calibration control, and training and qualification programs. If Contractor has submitted a General Quality Control Plan, only revisions to address the unique aspects of the Work are required to be submitted for a specific project.
5. ++Project Schedule - Contractor's schedule to perform the work as described in Section 01000.
6. **Welding Procedures and Qualifications - Contractor prepared welding procedures and procedures for and records of the qualification of operators for each type weld to be used.
- s. SD-21, Delivery Docket - Bill of lading for construction materials, giving supplier's mix number, time of batching, quantity delivered, Contractor's name, and time clear.

1.3 PREPARATION

- a. Identification - Mark each drawing sheet, data set, and sample to identify it by Project name and Contract number; Contractor name, address, telephone number; Subcontractor/supplier's name, address, telephone number; specification or drawing reference; submittal name and date.
- b. Drawings
 1. Drawings shall be prepared on translucent, reproducible sheets, between 8 1/2 in. x 11 in. and 24 in. x 36 in. in size; to accurate scale, with scale indicated.
 2. Submit one reproducible and four prints of each drawing. Two marked prints will be returned to the Contractor.
- c. Data
 1. Data submittals for each specific material, product, unit of work, or system shall be collected into a single submittal and marked for choices, options. Marking of each copy submitted shall be identical.
 2. Submit one original and four copied, indexed, and bound sets of

all data. Two marked copies will be returned to the Contractor.

- d. Samples - Provide sufficient quantity of material samples for tests. Submit one sample of each type; samples will not be returned. Materials and equipment incorporated in the work shall match the approved samples.

1.4 REVIEW AND DISPOSITION

- a. Contractor shall review submittals from subcontractors and suppliers to ensure compliance prior to submittal to the Contracting Officer. Contractor shall return any unsatisfactory submittals to the subcontractor for timely correction prior to submittal.
- b. Contractor shall furnish submittals to the Contracting Officer for COTR disposition.
- c. COTR will review submittals and provide pertinent disposition within 10 calendar days after receipt. Failure by COTR to complete the review within this time may be grounds for a time extension, but not for a change in contract price, unless the delay is over 30 days.
- d. COTR will return submittals with one of the following dispositions:
 - 1. "APPROVED" authorizes the Contractor to proceed with the work in accordance with the associated submittal.
 - 2. "APPROVED AS CORRECTED" authorizes the Contractor to proceed with the work in accordance with the associated submittal, provided no exceptions are taken to the indicated corrections. If Contractor takes exception to indicated corrections, resubmittal is required prior to proceeding with affected work.
 - 3. "RESUBMIT" requires the Contractor to make required additions and to resubmit for approval before proceeding with the work.
 - 4. "DISAPPROVED" indicates noncompliance with the contract requirements and requires the Contractor to make the necessary corrections and to resubmit for approval prior to proceeding with the work.
- e. Approval to proceed does not constitute acceptance or approval of the submittal, and does not relieve Contractor from full compliance with contractual obligations. Contractor's failure to point out deviations from the contractual requirements may result in COTR requiring removal and replacement of such work at Contractor's expense.
- f. If Contractor considers any correction or disposition to constitute a contractual change, it shall immediately notify the Contracting Officer.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

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SECTION 01400

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SECTION 01400

QUALITY CONTROL
08/06

PART 1 GENERAL

1.1 SCOPE

- a. This section applies to, and is a component part of, each section of the specifications.
- b. The work to be performed under this specification shall be accomplished in strict accordance with professionally recognized standards for building construction. The Contractor is solely responsible for the quality of construction and for making those submittals, inspections, and tests specified by the technical sections of this specification as the Contractor's responsibility. Contractor is also responsible for documentation and notifying COTR of the results of tests required.
- c. Contractor's in-house Quality Control program shall be used to the maximum extent possible, subject to meeting the requirements of this specification.

1.2 SUBMITTALS

The following shall be submitted per Section 01300, Submittals:

- a. SD-05, Mix Designs, at least 14 days before commencement of concrete, pavement, or masonry work, mix designs for concrete asphalt concrete and/or mortar shall be submitted. Use of a mix shall not begin before COTR's approval to proceed.
- b. SD-10, Test Reports. Test reports for Contractor-conducted tests will be submitted within one working day of completion of the test. Test reports for construction materials will be submitted at least 14 days prior to inclusion of the materials in the work. Reports are required for imported fill, asphalt concrete materials, masonry units, structural steel, and reinforcing steel.
- c. SD-13, Certificates of Compliance for each item of mechanical or electrical equipment shall be submitted prior to incorporating that piece of equipment into the work.
- d. SD-20, Quality Control Plan, within 7 days of the Notice to Proceed. No production or on-site work shall begin before COTR's approval to proceed.
- e. SD-20, Welding Procedures and Qualifications, 2 complete sets. Production welding shall not begin until COTR's approval to proceed. Each weld shall be stamped with the identification number of operator making that weld.
- f. SD-21, Delivery Certificates, shall be submitted within one working day of delivery of materials to the site. Certificates are required for imported fill, ready-mixed asphalt concrete, asphalt concrete

materials, ready-mixed concrete, concrete materials, metal decking, and roofing materials.

1.3 DEFINITIONS

- a. Inspection - Examination and test of supplies, services, materials, components, or assemblies to determine contract performance.
- b. Testing - Element of inspection that determines the properties or functional operation of materials or components, by the application of established scientific principles and procedures.
- c. Independent Testing Agency - An organization, approved by COTR, engaged to perform specific inspections or tests of work, either at the construction site, or elsewhere, and report the results.

PART 2 PRODUCTS

2.1 MANUFACTURE

- a. Materials, equipment, and fixtures to be provided shall be the standard catalog products of manufacturers regularly engaged in their manufacture; shall meet the specified and the detailed requirements; shall be suitable for the installation shown, and shall represent products that have been in satisfactory use for at least 2 years.
- b. Where two or more units of the same class are furnished, the units shall be from the same manufacturer and shall be interchangeable. Products shall be new, free from defects, and of the size, make, type, and quality specified and indicated in the manufacturer's catalog data.

2.2 DELIVERY AND STORAGE

- a. Materials, equipment, and fixtures shall be delivered to the site in their original, unopened containers, bearing labels identifying the manufacturer's name, brand name, and material, and while stored at the site, shall be fully protected from damage, dirt, debris, and weather.
- b. Products provided with a factory finish shall be fully protected during construction and shall be maintained free of dust, dirt, and other foreign matter. Dents, marred finishes, and other damage shall be repaired to the satisfaction of COTR, or the product shall be replaced at Contractor's expense.

PART 3 EXECUTION

3.1 GENERAL

- a. Conduct all inspections and tests, required by the specifications, on material and equipment fabricated off-site. Submit records of such tests and inspections to COTR at least 24 hours before incorporating the materials/equipment in the project.
- b. Unless otherwise specified, inspections and tests of on-site work, required by the specifications, of on-site work, shall be made by the Government inspector, who will provide a copy of the report to the Contractor.
- c. On-site tests conducted by the Contractor will be witnessed by the

Government inspector. At least 1 hour shall be allowed for Government inspection prior to any test. Should inspection reveal that corrective measures are required or that work is not complete, an additional 1 hour will be allowed to complete the Government inspection after all problems have been corrected and preparation has been completed.

3.2 DAILY INSPECTION

The work will be conducted under the general surveillance of COTR and Government inspectors to ensure compliance with the terms of the Contract. No inspector is authorized to change any provision of the specifications or other portion of the Contract Documents without written consent of Contracting Officer nor shall the presence or absence of an inspector relieve the Contractor from the requirements of the Contract.

3.3 SCHEDULED INSPECTIONS/TESTS

- a. Inspections and tests, other than day-to-day monitoring of field work, whether conducted by the Contractor or the Government, will be scheduled by the Contractor, with designated inspector, at least 24 hours in advance. Contractor shall provide time and access to conduct the inspection/test. Contractor shall not cover any work requiring inspection/test before that work has been approved by the Inspector. Failure to comply with this requirement may require the re-exposure of such work and recovering and repair, all at Contractor's expense.
- b. Scheduled Inspections - The following scheduled inspections are required, and will be performed by the Government. These are in addition to any required by other sections of this specification:
 1. Site utilities - Performed after piping, conduit, etc. is in place and bedded, but before it is encased or backfilled.
 2. Formwork/reinforcement - Performed after excavations, forms and reinforcement are complete, and before any concrete is placed.
 3. Underfloor - Performed after all in-slab or under-floor building service equipment, conduit, piping, accessories, and other ancillary items are in place, and before any concrete is placed or floor sheathing installed.
 4. Bolting/welding - Performed after all bolting/welding has been completed, but before it is covered by other work.
 5. Rough-out - Performed after light framing, rough plumbing, rough electrical, and ductwork is complete, and before sheathing, lath and drywall are applied.
 6. Sheathing - Performed after all sheathing, wallboard and lath are in place, but before roofing, taping, or other finishes are applied.
- c. Tests - The following tests are required, in addition to any required by other sections of the specification.
 1. Hydraulic testing of piping - Performed after piping is in place, but before it is covered. Hydraulic testing shall be performed by the Contractor.

2. Grounding/meggering - Required of all circuits designed for 480 V or more. Performed after all conductors are in place, but before final connection to the power source.
3. Slump test - Required of each load of concrete, prior to and during placement in the forms. In addition, sampling for compressive testing will be conducted when specified 28-day compressive strength is 2901 psi or more.
4. Density test - Required of each lift of backfill.

3.4 REPORTING

- a. Inspection/Test reports for Contractor-conducted tests shall be submitted within one working day of completion of the test.
- b. Inspection/Test reports for Government conducted tests will be transmitted to Contractor within one working day of completion of the test.
- c. Contractor shall not cover any item of work subject to inspection/test before results of inspection are satisfactory.

3.5 CORRECTIVE ACTION

Contractor shall promptly correct conditions that have resulted or could result in submission to the Government of supplies and/or services that do not conform to all of the quality assurance provisions of this specification, inspections/tests required, and other requirements to substantiate product conformance.

3.6 GOVERNMENT INSPECTION AT SUBCONTRACTOR OR VENDOR FACILITIES

The Government may inspect, at the source, all supplies or services not manufactured or performed at the site. Government inspection shall in no way replace Contractor inspection or otherwise relieve the Contractor of his responsibility to furnish an acceptable end item. When inspection at subcontractors' plants is performed by the Government, such inspection shall not be used by the Contractor as evidence of effective inspection by such subcontractors.

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SECTION 01500

ENVIRONMENTAL COMPLIANCE AND POLLUTION PREVENTION
08/06

PART 1 GENERAL

1.1 SUMMARY

- a. The pollution prevention, environmental compliance, and sustainability provisions described in this section apply to all work conducted on Ames Research Center and Moffett Federal Airfield under this contract.
- b. The information in this section is in addition to the requirements provided in the detailed sections.
- c. Sustainable or green building materials, practices and design will be utilized to the maximum extent possible to reduce pollution and facility impacts on natural resources while maximizing occupant health, safety and productivity. Project results will be evaluated using the Leadership in Energy and Environmental Design (LEED) Green Building Rating System.
- d. Contractor will consider the environmental life cycle costs of the project and proceed in a manner that minimizes these costs as well as preventing pollution, reducing facility impacts on natural resources and promoting environmentally sustainable solutions.

1.2 REFERENCES

Items marked with an asterisk are available for review in the Ames Research Center Main Library, Building N202.

Bay Area Air Quality Management District (BAAQMD)

BAAQMD Rules and Regulations	Air Quality
BAAQMD Regulation 8, Rule 3	VOC Content, Architectural Coating Limits
BAAQMD Regulation 8, Rule 49	VOC Content, Aerosol Coatings
BAAQMD Regulation 8, Rule 51	Volatile Organic Compounds, Adhesives and Sealants
BAAQMD Regulation 2, Rule 1	Permit Requirements
BAAQMD Regulation 11, Rules 1 & 2	Hazardous Air Pollutants Lead and Asbestos
BAAQMD Regulation 9, Rule 7	Boilers
BAAQMD Regulation 12, Rule 3	Asphalt Air Blowing
BAAQMD Regulation 12, Rule 4	Sandblasting

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.120	Emergency Response Awareness Level/Operators Training
29 CFR 1910.1200	Hazard Communication Training
40 CFR 82	Protection of Stratospheric Ozone
40 CFR 112	Oil Pollution Prevention
40 CFR 1500	National Environmental Policy Act
40 CFR 260	Proper Management of Hazardous Waste
40 CFR 265.16	Generator Training
49 CFR	Transportation
50 CFR 402	Endangered Species Act Regulations
40 CFR Part 247	Comprehensive Procurement Guidelines
10 CFR Part 435	Energy Conservation

CALIFORNIA CODE OF REGULATIONS (CCR)

CCR Title 22 Section 66260, etal	Hazardous Waste Management
CCR Title 22 Division 19	State Fire Marshal
CCR Title 22 Division 19.1	Office of Emergency Services
CCR Title 23	Waters
CCR Title 24, Part 6	California's Energy Efficiency Standard
CCR 66265.16	Generator Training

UNITED STATES CODES (USC)

16 USC 703	Migratory Bird Treaty
42 USC 6901	Resource Conservation and Recovery Act
42 USC 8251	Federal Energy Management
42 USC 13101- 13109	Pollution Prevention Act of 1990

NASA POLICY AND PLANS AND EXECUTIVE ORDERS

*AHB 8800.3	Ames Environmental Handbook
*SWPPP and BMPs	Storm Water Pollution Prevention Plan and Best Management Practices
*SPCC	Ames Spill Control and Countermeasures Plan
*June 20, 1990	NASA Policy on CFC and Halon Compounds

*EO 13101	Greening the Government through Waste Prevention
*EO 13123	Greening the Government through Energy Efficiency
*EO 13148	Greening the Government through Leadership
*EO 13150	Federal Workforce Transportation
SANTA CLARA COUNTY	
*NS-517.31	Santa Clara County Hazardous Materials Storage Permit Ordinance
*Sunnyvale Municipal Code 12	City of Sunnyvale Waters and Sewer Ordinance
*Palo Alto Chapter 16	City of Palo Alto Sewer Use Ordinance
*CAG6 12001 General	Industrial Storm Water Discharge Permit
*SCC NS-517.44	Santa Clara County Toxic Gas Ordinance

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01300, Submittals:

SD-01, Data

1. Site Inspection Checklists, every week for projects handling hazardous materials.
2. Request for Industrial Wastewater discharge form , at least 7 working days before commencement of discharge.
3. Hazardous Materials Inventories Statement (HMIS) and Material Safety Data Sheets (MSDS), at project commencement and as necessary to reflect changes in materials stored.
4. MSDSs of proposed coating and/or adhesive materials, before bringing these materials on-site.

SD-08, Statements

1. Hazardous Waste Disposal Subcontractors before project proposed commencement.
2. Hazardous Waste Profiles, and supporting analytical data before disposal.

SD-18, Records

1. Training records, before project commencement and personnel changes.
2. Records of wastewater discharges, including dates and quantities

of water discharged, weekly.

3. Spill Cleanup Records, as necessary.
4. Records of solvents and coatings usage with MSDSs, upon completion of project.

1.4 GENERAL RESPONSIBILITIES

The Contractor shall conduct project activities in a manner that protects surface/ground water and air quality, conserves resources, and minimizes the use of toxic chemicals and hazardous materials.

1.5 DEFINITIONS

- a. Hazardous Material - As defined by Chapter 6.95 of the State of California Health and Safety Code, any material that poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. Common examples are oil, fuel, caustic and acid cleaners, mineral spirits, petroleum distillate based solvents, oil based paints, aerosol spray paints, coolants and antifreeze, and solvents/cleaners containing chlorinated compounds.
- b. Solid Waste - Includes rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, construction, and agricultural operations, and from community activities.
- c. Reclamation - As defined by California Code of Regulations, Title 22, Section 66260.10 means that a material is processed to recover a usable product, or that it is regenerated. Examples are recovery of lead from spent batteries and regeneration of spent solvents.
- d. Hazardous Waste - As defined in California Code of Regulation Title 22, Section 66261.3. Hazardous Waste, includes extremely hazardous waste, acutely hazardous waste, RCRA hazardous waste, non-RCRA hazardous waste and special waste. Examples include waste paint, solvents, PCB transformers, contaminated soil, and oil.
- e. Non-Sewerable - Wastewater that contains at least one contaminant above the allowable discharge limit set by the Publicly Owned Treatment Works (POTWs) for discharge to the sanitary sewer.
- f. Recycle - to take something that would otherwise be thrown away and make it into something that can be used again. Examples include fluorescent light tubes and cardboard boxes.
- g. Sustainability - design and green building principles, which call for buildings that are designed, constructed, renovated, and reused in a resource and energy efficient manner.

PART 2 MATERIALS

2.1 AFFIRMATIVE PROCUREMENT - USE OF ENVIRONMENTALLY PREFERABLE PRODUCTS

- a. All products purchased for federal projects with federal funds, including contractors, are required by Executive Order 13101 and the Federal Acquisition Regulations (FAR) to assess and give preference to those products and services that are environmentally preferable.

Environmentally preferable products are of recycled content, recyclable, of low toxicity, reusable, locally produced, low-polluting, have long life cycles, are harvested on a sustained yield basis, and biobased.

- b. In addition, Executive Order 13101 and RCRA 6002 require the U.S. EPA to maintain the Comprehensive Procurement Guidelines (CPG), a list of products that MUST be purchased at the maximum recycled-content level specified. CPG items include: cement, concrete, latex paint, flowable fill, non-pressure pipe, blasting grit, industrial drums, manual grade strapping, mats, pallets, signage, and structural fiberboard.
- c. If federal funds, including contractors, purchase one of these products, the product must be purchased at the highest recycled content level practicable.
- d. The complete up-to-date list of CPG products and required recycled content levels is at <http://www.epa.gov/cpg/>.
- e. If this product is unacceptable based on quality, availability, or cost, a waiver must be filed with the Environmental Services Division. The waiver is available at http://q.arc.nasa.gov/qe/forms/recycle_waiver_req.pdf.
- f. For guidance on finding specific products that meet these requirements, please contact the Environmental Services Division.

2.2 AIR QUALITY

- a. Construction operations and materials used on the project shall be in compliance with the Rules and Regulations for Air Quality of the Bay Area Air Quality Management District (BAAQMD).
- b. Adhesives and Sealants - Adhesive and sealant products shall conform to Bay Area Air Quality Management District (BAAQMD) Regulation 8, Rule 51 for Volatile Organic Compound (VOC) content - Adhesives and Sealants.
- c. Architectural Coatings - Architectural coatings and paints shall conform to BAAQMD Regulation 8, Rule 3 for VOC content - Architectural Coating Limits.
- d. Spray Paints - Spray paints shall conform to BAAQMD Regulation 8, Rule 49 for VOC content - Aerosol Coatings.

2.3 STORAGE AREAS

- a. Hazardous Materials Storage
 1. Hazardous materials storage shall be in accordance with Santa Clara County Hazardous Materials Storage Ordinance No. NS-517.31, and the General Storm Water Permit. Hazardous materials shall be handled in manner that minimizes the potential for releases. All liquid hazardous materials must be secondarily contained. Adequate spill response equipment shall be readily available.
 2. Hazardous materials and hazardous wastes shall be labeled, handled properly, and stored in secondary containment at the end of each work day. Secondary containment shall be of adequate size and compatible with the materials stored. Storage areas shall be

properly labeled and secured.

3. At the beginning of the project, an accurate inventory of hazardous materials and hazardous wastes to be generated including the estimated maximum quantity of each hazardous material to be brought on-site shall be provided to the COTR. Material Safety Data Sheets (MSDSs) for hazardous materials shall be maintained by the Contractor so they are immediately available to assist emergency response personnel in the event of a hazardous materials incident.
- b. Staging Area - In accordance with the Clean Water Act and Ames Storm Water Pollution Prevention Plan (SWPPP), to the maximum extent practicable, the staging area must be located away from storm drain inlets, gutters, drainage ditches, storm drain inlets, and creeks.
 - c. Granular Material Storage - In accordance with the Clean Water Act and Ames SWPP, granular material shall be stored at least 10 ft from drainage ditches, catch basins, and curbs.
 - d. Refuse Bins - Refuse bins shall not be overloaded. Liquid materials shall not be placed in dumpsters or bins. Leaking dumpsters shall be replaced. Dumpsters and bins shall not be cleaned on-site. Dumpsters and bins shall be kept closed except when loading or emptying.
 - e. Landscaping - The Contractor shall control soil erosion and storm run-off to protect natural habitat from the project site to the satisfaction of the COTR.
 - f. Site Inspections - In accordance with Santa Clara County Hazardous Materials Storage Ordinance No. NS-517.31 the project site and all hazardous materials storage areas shall be inspected weekly by the Government to ensure compliance. In accordance with the project specific SWPPP, the Government shall conduct inspections prior to any forecasted storm event, every 24 hour period during extended rain events and after every storm event to ensure required BMPs were implemented and remained effective. The Contractor shall conduct daily inspections of roadways and on-site paved areas impacted by the project. Any visible debris, dirt or sediment shall be swept or vacuumed up. The Contractor shall implement corrective actions to the satisfaction of the Contracting Officer. Compliance status shall be verified by the Contractor using the applicable portion of the checklist in Attachment A, or equal. The checklists shall be submitted to Code QE, mail stop 218-1, within 48 hours following the inspection.

2.4 CHEMICAL USAGE AND HANDLING

- a. Hazardous material shall be used only as described on the Material Safety Data Sheet. The Contractor shall wear the protective equipment recommended by the manufacturer. Containers of hazardous materials and hazardous wastes shall be kept closed except when in use. Containers of liquid hazardous materials shall be stored in secondary containment at the end of each work shift.
- b. Reclamation of Equipment Containing Hazardous Material Residues - The Contractor shall disclose to COTR the facility to which equipment containing hazardous material residues are shipped for reclamation, such as electrical wire wrapped with asbestos and electrical panels containing asbestos. The disclosure shall be documented on the Bill of

Lading or by other written means.

- c. Disposal of Non-Hazardous Waste Containing Hazardous Material Residue - The Contractor shall disclose to COTR the facility to which equipment containing hazardous material residues are shipped for disposal, such as steel coated with lead paint. The disclosure shall be documented on the Bill of Lading or by other written means. Supporting analytical data shall be included to document the equipment is not hazardous waste.
- d. Labeling
 1. Containers, drums, vessels, tanks, and associated piping containing hazardous materials shall be labeled in accordance with California Code of Regulations Title 8 Section 5194 and the most recent edition of the Uniform Fire Code.
 2. Label containers with description of contents, percentages of components (if not pure), hazardous properties, name of contact person or waste generator, phone number, and date. If material is a waste, container shall have a hazardous waste accumulation label.

2.5 SUSTAINABILITY

The Contractor shall conduct its activities in a manner that conserves resources and minimizes pollution in accordance with Executive Order 13101 "Greening the Government Through Waste Prevention, Recycling and Federal Acquisition", Executive Order 13123 "Greening the Government Through Efficient Energy Management", Executive Order 13148 "Greening the Government Through Leadership in Environmental Management", and the Presidential Memorandum on Environmentally and Economically Beneficial Landscape Practices on Federal Landscaped Grounds.

- a. Minimize the amount of energy required during construction and operation by using resource efficient construction techniques.
- b. Whenever possible, utilize energy efficient office equipment through the Environmental Protection Agency's Energy Star labeling program (@ <http://www.epa.gov/energystar/>).
- c. Conserve water with systems that reduce consumption and recycle water through reclamation and treatment systems.
- d. Maximize the reduction, reuse, recycling or composting of waste and scrap materials.
- e. Minimize waste, spillage, pilferage, spoil, and misuse of building materials.
- f. Follow federal Comprehensive Procurement Guidelines (@ <http://www.epa.gov/epaoswer/non-hw/procure/>) for building materials and products, and select materials that have a long-life cycle; select least toxic materials; select recyclable materials; select materials that are resource-efficient; select materials with the maximum recycled content; select materials harvested on a sustained yield basis; select products causing the least pollution during their manufacture, use and reuse.
- g. Reduce, reuse, and recycle to minimize consumption and waste in business operations.

PART 3 OPERATIONS

3.1 WASTEWATER DISCHARGE PERMITS

- a. In accordance with the Clean Water Act, the City of Sunnyvale Water and Sewers Ordinance, and the City of Palo Alto Sewer Use Ordinance, a specific written Incidental Sewer Discharge permit is required before discharging wastewaters to the sanitary sewer system from project activities such as excavation dewatering, saw cutting coolant water, cleaning operations, and decontamination water.
- b. The Contractor shall complete and submit a Request for Incidental Sewer Discharge form to the COTR at least 7 work days before the planned discharged of groundwater or other wastewater. The request shall include the estimated discharge volume, discharge rate, source of the wastewater and the duration of discharge. The Government will sample the wastewater and obtain the discharge approval.
- c. Wastewater Discharge
 1. With the exception of groundwater from excavation, wastewater from Contractor operations shall be containerized by the Contractor until the Contractor is notified a discharge permit has been obtained.
 2. The Contractor shall record and submit information specified in the discharge permit issued to the project including, but not limited to, the dates of discharge, quantity of water discharged, source of the wastewater, dates wastewater was sampled and analyzed (if required), and filtering method (if required).
 3. Non-sewerable wastewater shall be disposed of by the Government in accordance with Paragraph 3.9, Government Disposal.
 4. Non-sewerable wastewater shall be treated, managed, and disposed of properly by the Contractor in accordance with Paragraph 3.10, Contractor Disposal.
- d. Groundwater Discharge - Groundwater from excavations shall be discharged in accordance with Section 02200, Site Preparation and Earthwork.

3.2 TRAINING REQUIREMENTS

- a. All personnel shall be trained in the hazards and safe work practices for their tasks.
- b. Personnel performing hazardous operations shall receive training as specified in applicable regulations.
 1. Personnel handling hazardous materials shall have received Hazard Communication Training per 29 CFR 1910.1200 and CCR Title 8 Section 5194 and Emergency Response Awareness Level training per 29 CFR 1910.120. Employee training documents shall be kept at the jobsite.
 2. Personnel containing spills or conducting cleanup of small spills shall have received First Responder Operations level training per

29 CFR 1910.120.

3. Personnel generating hazardous waste shall receive training on the proper management of hazardous waste per 40 CFR 265.16 and CFR Title 22 Section 265.16.
 4. Personnel using personal protective equipment (PPE) shall receive training on its proper use per 29 CFR 1910.132.
- c. Personnel handling hazardous materials shall have received Hazard Communication Training per 29 CFR 1910.1200 and CCR Title 8 Section 5194 and Emergency Response Awareness Level training per 29 CFR 1910.120. Employee training documents shall be kept at the jobsite.
 - d. Personnel containing spills or conducting cleanup of small spills shall have received First Responder Operators level training per 29 CFR 1910.120.
 - e. Personnel generating hazardous waste shall have receive training on the proper management of hazardous waste per 40 CFR 66265.16 and CFR Title 22 Section 66265.16.
 - f. All Contractor personnel involved in operations with potential to impact storm water quality or the storm drain system shall have awareness training regarding the project specific SWPPP and the applicable BMPs. Documentation of this training shall be provided to the Government.

3.3 SITE OPERATIONS AND MAINTENANCE

- a. Site Operations shall be conducted in accordance with the Clean Water Act and Ames Storm Water Pollution Prevention Plan.
- b. Equipment Fueling and Maintenance - In accordance with the applicable BMP, equipment fluid changes and fueling shall be conducted over drip pans to prevent spilled materials from contacting the ground surface. The operator of leaking equipment shall contain and control the leak. All other maintenance and repairs of Contractor equipment is prohibited on-site.
- c. Paint Clean-up
 1. Painting operations must be conducted in accordance with Ames Storm Water Pollution Prevention Plan and applicable BAAQMD requirements.
 2. Water Based Paints
 - a) The Contractor shall paint out as much excess paint as possible from brushes, rollers, and equipment before starting clean up. Rinse brushes, rollers, and other tools over a sink that drains to the sanitary sewer using water only. Tools and equipment shall not be cleaned into streets, gutters, storm drains, or creeks. Dispose of dry brushes, rollers, rags, and drop cloths as solid waste.
 - b) Disposal of containers with any liquids as a solid waste is prohibited. These materials must be used elsewhere or handled as a hazardous waste and disposed of in accordance with Paragraph

3.10, Contractor Disposal.

3. Oil Based Paints

a) The Contractor shall paint out as much excess paint as possible from brushes, rollers, and equipment before starting clean up. Cleaning wash water shall be containerized and disposed of as hazardous waste. Reuse thinners and solvents by pouring back into original container through a filter.

b) Dispose of waste thinners, solvents, paint sludge, and wash water from cleaning of equipment and tools as hazardous waste. Containers with residual product shall be managed as a hazardous waste and disposed of in accordance with Paragraph 3.10, Contractor Disposal.

d. Paving Operations

1. Catch basins and manholes shall be protected when paving or applying seal coat, tack coat, slurry seal, or fog seal. Sweeping or washing down excess sand (from applying sand seals or covering excess oil) into gutters, storm drains, or creeks is prohibited. Excess materials shall either be collected and returned to the stockpile or disposed of properly.

2. Paving operations shall not obscure existing utility boxes, ground water monitoring wells, manholes, valve boxes or similar features. Notify the COTR of any features potentially impacted.

- e. Concrete/Asphalt Cutting and Core Drilling - In accordance with the applicable BMP, the Contractor shall not allow slurry run-off from saw cutting or core drilling to enter the storm or sanitary sewer collection systems. Catch basins and drains shall be protected. The Contractor shall sweep/shovel up slurry cutting waste from work areas before leaving an area or at the end of each work day, whichever is sooner. If saw-cut slurry enters a drain, the Contractor shall remove the slurry and notify the COTR immediately.
- f. Concrete Truck/Wash Out - In accordance with the applicable BMP, washing out concrete trucks or equipment into streets, gutters, storm drains, or creeks is prohibited. Trucks may be washed out on the ground surface in a location approved by the COTR.
- g. Sweeping - Roadways and on-site paved areas impacted by the project shall be cleaned as necessary to the satisfaction of the COTR and swept at the end of each phase or at project completion. Hosing down paved areas and streets is prohibited.
- h. Reclaimed Water - The Contractor shall use reclaimed water for dust control and other construction site operations unless an exception is granted by the COTR. Reclaimed water is available at no cost from a hydrant located on Moffett Federal Airfield approximately 328 ft west of the intersection of Macon Road and Fifth Avenue.
- i. Storm Drain Management
1. In accordance with the applicable BMP, catch basins near the project shall be protected to prevent debris, pollutants, sediments and releases from entering the storm drain system.

Catch basins shall be inspected and cleaned out to the satisfaction of the COTR at the end of each phase or at project completion.

2. In accordance with the applicable BMP, the Contractor shall control soil erosion and storm runoff from the Contractor's site to the satisfaction of the COTR.
- j. Broken/Ruptured Pipes - If the Contractor breaks a utility pipe, or observes any broken or leaking pipes, it shall immediately notify the COTR. The Contractor shall immediately notify Ames Environmental Office if the pipe contained any liquid except potable water. The Contractor shall berm the area to prevent run-off from releases of non-potable water from entering the storm drain.
- k. Draining, Tanks, Piping, and Equipment
1. Tanks, piping, and equipment shall be drained as required. Devices to properly contain the product shall be provided by the Contractor. Storm drains in the vicinity shall be covered during drainage operations.
 2. The Government will conduct the sampling of drained fluid in order to determine disposal options unless there is sufficient generator knowledge to determine disposal options.
 3. The Government will obtain the necessary sanitary sewer discharge permits if the discharge is sewerable. Non-sewerable water shall be treated to a level to allow discharge to the sanitary sewer or managed and disposed of properly.
 4. Disposal of drained fluid and associated costs shall be by the Government in accordance with Paragraph 3.9, Disposal.
- l. Contaminated Soil Management
1. The Contractor shall notify the COTR immediately if soil appears discolored or has an odor. The Contractor shall place suspect soil on plastic sheeting and cover with a plastic tarpaulin. The suspect soil will be tested by the Government for contamination.
 2. Contaminated soil shall be transferred to a designated on-site location for disposal by the Government in accordance with Paragraph 3.9, Disposal or properly disposed of by the contractor in accordance with paragraph 3.10.
- m. Authorized Non-Storm Water Discharges
1. Following is a list of authorized non-storm water discharges:
 - a) Potable water including drinking water and water related to the operation, maintenance or testing of potable water systems provided that the water does not become contaminated with soil or sediment (muddy).
 - b) Atmospheric condensate including refrigeration, air conditioning and compressor condensate.
 - c) Irrigation drainage and landscape watering.

- d) Uncontaminated ground water provided that the water does not become contaminated with soil or sediment (muddy).
- e) Water from fire hydrant flushing or testing.
- f) Water from fire fighting activities.

- 2. To the extent practicable, authorized non-storm water discharges shall be minimized. Additionally, the Environmental Services Office shall be notified of all authorized non-storm water discharges so that they may be observed and/or documented as required by the Industrial General Storm Water Permit.

3.4 ELECTRICAL PCB SPILL CLEAN UP

As specified in Section 16000, Electrical.

3.5 SPILL PREVENTION, CONTROL, AND REPORTING

- a. All liquid petroleum products must be secondarily contained in accordance with Ames Spill Prevention Control and Countermeasures Plan and 40 CFR 112, spill clean-up materials (such as rags, absorbent booms/pads), and tools (such as shovels and brooms) shall be maintained at the project site and be readily accessible. Releases of hazardous materials to the environment shall be contained and measures implemented to prevent leaks and spills from entering storm drains. Spills of hazardous materials to unpaved surfaces in excess of 1 ounce shall immediately be reported to Ames Environmental Office.
- b. Dial 911 from any NASA phone or 650-604-5555 from an outside phone to request assistance of any spill by the Contractor.

3.6 BURROWING OWL HABITAT

- a. The Contractor shall conduct its activities in a manner that does not negatively impact fauna or flora, in accordance with 40 CFR 1500, 50 CFR 402, and Ames Environmental Procedural Requirement, APR 8800.3.
- b. The Contractor shall comply with the "Burrowing Owl Management Policy for Ames Research Center."

3.7 LEAD ABATEMENT

As specified in Section 02090, Lead Abatement/Demolition.

3.8 ASBESTOS ABATEMENT

As specified in Section 02080, Asbestos Abatement/Demolition.

3.9 GOVERNMENT DISPOSAL

- a. The Contractor shall label, package, and secondarily contain hazardous wastes before submitting the hazardous wastes to the Government for subsequent disposal.
- b. Hazardous Waste Manifest
 - 1. NASA Ames Research Center shall be designated as the generator on

the manifest and only approved Ames Environmental Office personnel shall sign the Uniform Hazardous Waste Manifests. Contractors shall not sign hazardous waste manifests.

2. NASA Ames Research Center Environmental Office shall be designated as the emergency contact.

3.10 CONTRACTOR DISPOSAL

- a. Hazardous wastes generated by materials brought on site by the Contractor shall be properly handled, shipped, and disposed of as required by federal, state, and local regulations. No hazardous materials shall remain at the worksite upon completion of the project unless specified otherwise. The Government shall sample waste streams for purposes of waste characterization. Waste Profiles shall be submitted to the COTR. Hazardous wastes shall be disposed of at a permitted Treatment, Storage, and Disposal Facility (TSDF) authorized to accept the specific waste to be shipped. Use of deep well injection as a treatment or disposal method is prohibited.
- b. Hazardous Waste Manifest
 1. NASA Ames Research Center shall be designated as the generator on the manifest and only approved Ames Environmental Office personnel shall sign the Uniform Hazardous Waste Manifests. Contractors shall not sign hazardous waste manifests.
 2. NASA Ames Research Center Environmental Office shall be designated as the emergency contact.
 3. The Contractor shall perform disposal services in compliance with 49 CFR. The Contractor shall meet the removal and disposal time frames established by law.
 4. The Contractor shall use only disposal facilities that have a valid permit to manage hazardous waste, and shall be responsible for determining that permit allows for the type of management and disposal intended for that waste. The Contractor shall be responsible for ensuring that any party handling hazardous waste, including subcontractors, transporters, and TSDFs are in compliance with applicable federal, state, and local regulations.
- c. Treatment, Storage, And Disposal Facility List - The Contractor shall provide a list of storage and disposal facilities (TSDF) that perform treatment, storage, or disposal services under this contract. Each facility shall have, as a minimum, EPA RCRA interim status or state approval as a treatment or disposal facility and be in good standing with the regulatory community. Recycling facilities shall meet applicable federal, state, and local regulations. The Contractor agrees that no facility other than those initially approved for use under this contract will be used, without first obtaining the written approval of the COTR.
- d. Hazardous Waste Liability - For the purpose of this contract, the Contractor shall be responsible for any release or threatened release of the materials or substances handled under this contract, as well as any liabilities resulting or arising from or related to this contract, and shall bear all costs pertaining to such releases including, but not limited to, responses, remediation, testing, or disposal costs, and

further shall defend and indemnify the Government for any costs including, but not limited to, any judgments, penalties, assessments, litigation, or attorney fees.

- e. Hazardous Waste Transportation - Certified Waste Haulers shall be utilized. Government directed waste shall be transported to the disposal facility or interim storage facility without delay, in accordance with Department of Transportation (DOT) manifest regulations. The Contractor shall notify the Government if 10 days or more have elapsed during shipment.
- f. Containerized Hazardous Waste - Hazardous wastes and other materials picked up by the Contractor from other facilities may not be added to any container of Government hazardous waste.
- g. Bulk Hazardous Waste - Bulk hazardous waste shipments shall be weighed to confirm shipping weight.
- h. Fluorescent Light Tubes - Fluorescent light tubes removed by the Contractor shall be turned over to the Government for recycling.

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SECTION 02050

ALTERATIONS AND DEMOLITION
08/06

PART 1 GENERAL

1.1 SUMMARY

This section specifies work involving alteration, demolition, and/or removal of existing buildings, materials, equipment, or utilities.

1.2 SUBMITTALS

Submit the following per Section 01300, Submittals:

SD-18, Record of Existing Conditions

SD-20, Work Plan

1.3 TEMPORARY PROTECTION

Provide temporary enclosures and partitions before starting work to prevent unauthorized entry, to protect personnel from noise and construction operations, and to protect existing materials, finishes, equipment, and building components from damage by construction operations.

PART 2 PRODUCTS

Products are not required for this section.

PART 3 EXECUTION

3.1 DISCONNECTING EXISTING UTILITIES

- a. Install temporary utility services before disconnecting existing utilities. Maintain temporary services during period of construction, and remove them only after permanent utilities have been installed, tested, and are in operation.
- b. All electrical power in areas within scope of work will be de-energized, locked/tagged out, with coordination between the Contractor and the Government (Ames Research Center Plant Engineering Branch). The Contractor shall apply his locks in conjunction with the Government's to assure mutual safety.

3.2 PRECAUTION AGAINST MOVEMENT

Provide shoring and bracing or other supports to prevent movement, settlement, or collapse of facilities adjacent to areas requiring alteration and removal.

3.3 SALVAGE AND REUSE

- a. The Government will designate materials and equipment to be salvaged.

- b. Remove salvageable materials and equipment so as to cause the least possible damage thereto. Handle, sort by type and size, store off ground, and protect salvaged items that will be reused in Work or will be retained by the Government. Provide identification tags indicating type, size, and quantity of materials for items boxed or placed in containers.
- c. Recondition salvaged materials and equipment required for reuse in areas of new construction before installation. Repair or replace, as necessary, items damaged during removal and salvage operations.

3.4 DEMOLITION

- a. CONCRETE DEMOLITION- Perform concrete demolition using wet methods to eliminate visible dust, which can result in excessive silica inhalation. If visible dust occurs, perform silica dust personal air monitoring to confirm the adequacy of controls.
- b. COATED WOOD DEMOLITION- If the wood is coated in paint contaminated with heavy metals, the wood shall be managed as hazardous waste. The wood shall be contained and the container kept closed except when being loaded. The containers shall be verified as closed at the end of each work day.

3.5 DISPOSAL

- a. Debris, rubbish, scrap, and other materials not designated to be salvaged or reused in Work become Contractor's property. Remove such materials and dispose of them legally off worksite.
- b. Burning of materials is prohibited on Government property.
- c. For mechanical piping, equipment, and fixtures containing oil, the oil shall be drained (and managed as hazardous waste) prior to removal.
- d. Aboveground storage tanks and associated piping containing oil shall be certified as clean in accordance with Title 22, Chapter 32, Management of Tanks, before being sent to a metals recycler on a bill of lading. The Contractor's work plan shall address the cleaning process to be used for the piping and tank(s).

3.6 ALTERATION

- a. Where required to patch or extend existing construction, match existing materials and exposed surfaces. Employ experienced mechanics for cutting, patching, repairing and other alteration work.
- b. Recycling of scrap metal and concrete from large demolition projects shall be conducted to the maximum extent practical.

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SECTION 02080

ASBESTOS ABATEMENT

PART 1 GENERAL

1.1 SUMMARY

- a. The Contractor shall furnish labor, materials, services, and equipment necessary for the complete enclosure, encapsulation, removal, and approved disposal of asbestos located at the jobsite and asbestos-contaminated materials resulting from the work performed.
- b. Work shall be performed per documents referenced herein, and per applicable federal, state, and local regulations. Nothing specified herein shall be construed as waiving any legal requirements.
- c. All High Efficiency Particulate Air (HEPA) filtered air pressure differential machines and vacuums shall be DOP certified. This certification must accompany all High Efficiency Particulate Air Filtration Systems (negative air machines and vacuums) brought onto NASA property. The DOP test must have been conducted within the last 30 days, and must be re-tested every 30 calendar days. Copies of all DOP certifications shall be submitted to the NASA ARC asbestos representative.
- d. Asbestos Containing Materials are defined by the NASA Ames Asbestos Management Plan as any material that contains more than 0.1% of asbestos.

1.2 REFERENCES

Contractor shall abide by the provisions and recommendations of the following:

U.S. DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY & HEALTH
ADMINISTRATION (OSHA)

- 29 CFR Part 1910.1001 Asbestos Regulations
- 29 CFR Part 1910.134 Respirator Regulations
- 29 CFR Part 1926.1101 Construction Asbestos Regulations

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

- 40 CFR Part 61 National Emissions Standards for Hazardous Air Pollutants (NESHAPS) - Subpart M - National Emission Standards for Asbestos
- 40 CFR Part 763 Subpart E Asbestos Emergency Response Act (AHERA)
- EPA Guidance Documents
- Guidance for Controlling Asbestos-Containing Materials in Buildings

BAY AREA AIR QUALITY MANAGEMENT DISTRICT (BAAQMD)

- Regulation #11, Rule #2 Asbestos
- California Labor Code Sections 6501.5, 6501.7, 6501.8, and 6505.5
- CALIFORNIA CODE OF REGULATIONS (CCR)
- Title 8, Section 1529
- Title 8, Section 5208-5208.1
- Title 8, Section 1529
- Title 8, Section 5144
- Title 8, Sections 341.6-341.14 Registration - Asbestos Related Work
- Title 22, Sections 22-12000 and 22-12901(Proposition 65)
- Title 26, Divisions 22 and 23

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI, Z.9.2 Fundamentals Governing the Design Operation of Local Exhaust Systems
- National Electrical Code
- National Plumbing Code
- National Plumbing Code
- California Business & Professions Code Section 7058.5

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- ASTM 1368-03 Standard Practice for Visual Inspection of Asbestos Abatement Projects

1.3 SUBMITTALS

Submit the following prior to start of work, per Section 01300, Submittals:

SD-04, Shop Drawings

Shop Drawings, showing layout of work areas including areas to be modified and emergency egress routing and exits, and showing locations of clean room/change area, shower (if any), equipment room, and negative air machines.

SD-06, Instructions

- a. Material Safety Data Sheets (MSDS's) for chemicals brought onto the site.
- b. Copy of respirator program complying with 29 CFR Part 1910.134.

- c. Procedure(s) for evacuation of injured workers (aid for seriously injured workers shall not be delayed for reasons of decontamination).

SD-08, Records

- a. A copy of the contractor's/subcontractor's [Asbestos Abatement Contractors license](#) issued by the California Contractors State Licensing Board.
- b. A copy of the [contractor's/subcontractor's registration for asbestos-related work](#) issued by CAL-OSHA.
- c. A copy of the [notification for proposed asbestos-related work](#) provided to CAL-OSHA and the BAAQMD.
- d. A copy of the [contractor's/subcontractor's insurance policy for asbestos-related work](#), general liability, and workers compensation, as well as insurance coverage for future asbestos-related claims. Ensure that the monetary amounts are sufficient for the scope of work being performed.
- e. A copy of the [site-specific health and safety plan](#).
- f. A copy of the [contractor's/subcontractor's Hazard Communication and Respiratory Protection Programs](#).
- g. A copy of all [contractor's/subcontractor's employee EPA-approved asbestos-related training certificates, licensed physician medical evaluations, and respiratory fit-test certifications](#).
- h. A copy of the [hazardous waste hauler's permits/licenses](#).
- i. A copy of the [hazardous waste landfill permits/licenses](#).

SD-20, Work Plan

[Work Plan](#), outlining containment and removal procedures, the number, location, and type of HEPA ventilating units, the quantity and location of on-site waste storage, the name and location of the approved disposal site, and the proposed air monitoring program.

- a. Written plan for containment and waste removal, including the number and location of negative air machines, and quantity and location of on-site waste storage containers.
- b. Copy of initial exposure assessment, if required to support the work plan.

Submit the following during and after work per Section 01300, Submittals:

SD-01, Data

[Data](#), including copy of Contractor-performed risk assessment per [29 CFR Part 1926.62](#), to be approved before any reductions in controls.

SD-08, Records

- a. Copies of Contractor-performed air monitoring tests to be submitted within 24 hours of the sampling.
- b. Original records of "negative-air pressure" measurements in containments from circular chart-recording manometers to be submitted within five days of completion of work.
- c. Upon completion, copies of all manifests for asbestos containing waste to be submitted within five days of completion of work.
- d. All updated training, medical, and fit-test documents to be submitted within 24 hours of expiration.
- e. Within five days of completion, a copy of all manifests for asbestos-containing waste shall be submitted. Each manifest shall be accompanied by a certified weight slip.

1.4 NOTICE

Contractor shall make the following written notifications at least 14 days prior to starting work, as required by applicable regulations.

- a. California Occupational Safety and Health Administration
1900 S. Norfolk, Suite 215
San Mateo, CA 94403
- b. Bay Area Air Quality Management District (BAAQMD)
939 Ellis Street
San Francisco, CA 94109

1.5 PERMITS AND LICENSES

The Contractor must possess current permits and licenses as required by applicable regulations, including the following:

- a. INDUSTRIAL WASTE HAULER PERMIT, specifically for asbestos materials or LICENSED HAZARDOUS WASTE HAULER PERMIT (required for actual hauler).
- b. CALIFORNIA ASBESTOS CONTRACTOR'S LICENSE.
- c. CALIFORNIA GENERAL CONTRACTOR'S LICENSE or CALIFORNIA SPECIALTY CONTRACTOR'S LICENSE.

1.6 SIGNS AND LABELS

- a. Provide and post adequate warning signs at designated entrances to the regulated area, as required by Cal/OSHA, Proposition 65 (Title 26, Division 21.5), and the EPA.
- b. Provide and post, in the clean room and the equipment room (if applicable), the decontamination and work procedures to be used by all workers and visitors.
- c. Provide appropriate warning labels and Class 9 placards pre-printed on all asbestos waste bags, and affix the same labels on other types of waste containers immediately after asbestos waste is placed in the containers.

- d. All waste bags, drums, containers etc shall have the manifest number, generator name and phone number and the BAAQMD phone number.

PART 2 PRODUCTS

2.1 WORK CLOTHING

Provide for each person that will be entering the work area(workers, supervisors, inspectors, and others) work clothing consisting of full body disposable coveralls, disposable head covers, boots (chemical resistant as necessary), protective gloves (chemical resistant as necessary), goggles (eye protection), and respirators. Other safety clothing shall be available as appropriate.

2.2 MISCELLANEOUS EQUIPMENT

- a. Equip all vacuum cleaners with HEPA filters meeting [UL 586](#) requirements.
- b. All equipment brought onto NASA property must be free of visible dust and debris.
- c. All vacuums and negative air machines shall pass DOP certification per Section 1.1C.
- d. All negative air machine exhaust duct shall be wire reinforced.

PART 3 EXECUTION

3.1 REQUIREMENTS BY TYPE OF OPERATION

- a. Perform operations using the work practices and controls specified by [29 CFR 1926.1101](#) (g), Methods of Compliance. If alternative control methods are proposed, these must be submitted to and be approved by the COTR and the NASA Safety Office prior to beginning work.
- b. Use respiratory protection at least as stringent as specified by [29 CFR 1926.1101](#) (h). As a minimum, a powered air purifying respirator (PARR) shall be used for all Class I removal and bagging operations, if a negative exposure assessment has not been performed. As a minimum, half-mask respirator shall be used by employees engaged in Class II removal, bagging, waste-handling, and cleanup operations, and those engaged in all waste-handling and cleanup operations, shall wear half-mask respirators, at a minimum.

3.2 PREPARATION

- a. Prior to beginning work, remove all furniture and equipment from the work area. Any equipment or furniture that cannot be removed shall be completely enclosed with 6 mil thick fire-retardant polyethylene sheeting, securely taped in place with duct tape. Draping and taping of piping is also required.
- b. If a negative-pressure enclosure (NPE) or critical barrier is required per [29 CFR 1926.1101](#)(g), the Contractor shall thoroughly seal all openings and fixtures including, but not limited to, heating and ventilating ducts, skylights, doors, windows, and lighting with polyethylene taped securely in place.

1. All critical barriers shall be sealed using, as a minimum, 6-mil

thick fire-retardant polyethylene sheeting taped securely in place. Care must be taken in sealing off lighting fixtures/transformers to avoid burning or melting the plastic sheeting.

2. All air handling systems affecting the regulated area shall be turned off and tagged out during the abatement operation (where feasible).
- c. All electrical power in the work area shall be disconnected and tagged out, unless a GFCI-protected circuit is used at the point of connection to the electrical systems.

3.3 WORK AREA ISOLATION

a. Regulated Area

1. Establish the work area as a regulated area either by use of an NPE or by other means of acceptable demarcation.
2. Remove all PPE (suits, foot wear, gloves, eye protection, etc.), except respirators, prior to departure from the regulated work area.
3. No smoking, eating, or drinking etc. shall take place in the regulated area.

b. Negative Pressure Enclosure

1. Clearly mark exits and emergency exits from the enclosure.
2. Maintain a minimum average negative pressure differential of **-0.03 inches** of water inside the containment. At no time shall the negative pressure differential fall below **-0.02 inches** of water. If the negative pressure differential falls below **-0.02 inches** of water, work shall be stopped and corrective action taken.
3. Use an electronic pressure differential circular chart-recording manometer to record the negative pressure differential in the containment. The manufacturer shall have serviced the manometer within the last 365 days. The circular charts shall be signed and dated by the supervisor daily. The recorder shall function continuously throughout the abatement operation. All manometer charts are to be set on single day recording; if work continues over a weekend, any "unmanned" manometer can be set to print on a three or five day record. The Government may check the negative pressure with a calibrated magnehelic.
4. Submit copies of all charts within two days of recording.

3.4 DECONTAMINATION

- a. Perform decontamination of personnel in accordance with **29 CFR 1926.1101 (j)**.
- b. Prepare and distribute procedures for evacuation of injured workers. Aid for a seriously injured worker will not be delayed for reasons of decontamination. Submit the procedure to the COTR and Safety office for approval.

- c. Seal, label, and clean the outside of containers or place into a clean bag just prior to removing from the work area.

3.5 AIR MONITORING

- a. The Contractor shall be fully responsible for personal air monitoring needed to demonstrate compliance with OSHA and Cal/OSHA regulations and standards of good practice in worker protection.
- b. For Class I abatement jobs involving more than 26.25 ft or 10.76 ft² of material, provide perimeter air monitoring as required by 29 CFR 1926.1101, (g). (4) (ii) (B). All air sampling results must be less than 0.01 fiber/cm³ by PCM or 70 structures/mm² by TEM (AHERA). Engineering controls must be instituted to achieve this criterion.
- c. If, at any time, the air samples collected inside the work area exceed the PEL, all active abatement work shall stop immediately. The Contractor shall re-evaluate existing engineering controls and implement new, COTR-approved engineering controls in conjunction with cleaning the work area. If the PEL is exceeded three times on the same contracted project work, the Contractor shall implement the use of Type C respirators (air supplied) for all workers entering the work area.
- d. For Class I abatement jobs involving more than 26.25 ft or 10.76 ft² of material, the Government may provide perimeter air sampling as required by 29 CFR 1926.1101, g. (4) (ii) (B). TEM air samples shall be used to confirm decontamination of work area and will be collected within 48 hours after completion of the work. The Certified Asbestos Consultant (CAC) will determine the number, location and type of samples to be taken.

3.6 REMOVAL

- a. Remove asbestos-containing material as specified by 29 CFR 1926.1101 (g).
- b. If pipes, valves, or structural members are covered with and/or contain asbestos, remove them as units where feasible. Wet and double wrap these units with two layers of 6-mil thick polyethylene sheeting. Securely seal polyethylene sheeting along all seams and "candy stripe" with duct tape and affix labels.

3.7 CLEANUP/CLEARANCE

- a. Properly package, label, and remove all waste containing asbestos from the work area to the holding area or hazardous waste container. Remove all unnecessary equipment and materials from the work area. Wet-clean or HEPA vacuum the entire area. Notify the COTR that the work area is ready for inspection. Utilize secondary hard shell containers when transferring poly waste bags through public use areas.
- b. Upon approval of the visual/tactile inspection by the COTR and a CAL-OSHA-certified consultant, the Contractor may apply a fine spray of lock-down encapsulant. Any secondary barriers or protective coverings will be removed prior to clearance testing. The encapsulant shall meet the requirements of ASTM for life (C732), flame (E84), and bonding (E736).

- c. At the discretion of the CAL-OSHA-certified consultant, the use of fans and leaf blowers may be used to disturb the vertical and horizontal surfaces within the work area as described in 40 CFR 763.
 - d. The placement and number of air samples to be collected in a work area are at the sole discretion of a CAL-OSHA-certified inspector.
 - e. All Transmission Electron Microscopy (TEM, AHERA) clearance air samples collected in the work area must be less than 70 structures/mm². If Phase Contrast Microscopy (PCM) is the method of clearance, then all air samples must be less than or equal to 0.01 fibers/cm³. When the work area meets one of these criteria, the Contractor can remove all remaining barriers, enclosures, and equipment. All barriers and enclosures shall be packaged and disposed of as hazardous asbestos-containing waste.
 - 1. The method for analysis of PCM air samples shall be NIOSH 7400, A Rules.
 - 2. The method for analysis of TEM air samples shall be AHERA as described in 40 CFR 763, Final Rule and Notice.
 - f. If all clearance air samples collected in the work area do not meet the established clearance criteria, the Contractor shall wet wipe and HEPA vacuum the entire work area again. A new set of clearance air samples shall be collected.
 - g. After all barriers/enclosures have been removed, the surfaces/areas that were covered shall be wet cleaned and HEPA vacuumed.
- 3.8 DISPOSAL
- a. Asbestos-containing waste, friable and non-friable, containing more than 1 percent asbestos shall be handled as hazardous waste and transferred to a designated on-site location.
 - b. Asbestos-containing materials and all materials contaminated during operations shall be sealed in double-containers. The inner container shall be a 6-mil thick polyethylene bag (or wrapping). The outer container may be an additional 6 -mil (0.15 mm) thick bag or wrapping, or a sealed drum. The outer container must be cleaned and labeled (per 40 CFR 262, Title 26, Sections 22-66262 et seq., and other applicable regulations) before removal from the equipment room or work area.
 - c. Clean, sealed bags/containers may be stored in a holding area adjacent to the work area until a sufficient volume has accumulated for disposal, but not for longer than 30 days. The holding area will be prominently marked, and waste containers will be covered with plastic sheeting and protected from damage.
 - d. Asbestos wastes will be carefully handled to prevent container rupture and release of asbestos fibers. Workers loading or unloading asbestos waste shall wear approved respirators.
 - e. The performing Contractor shall be fully responsible for hauling asbestos wastes to a designated on-site location for Government disposal. the disposal of waste in an approved landfill in accordance with the rules and regulations of the California Department of Health Services, the Regional Water Quality Control Board, and any other

applicable agency. Removal from the site shall be by a licensed hazardous waste hauler, and the manifest shall be signed by a civil servant representative of NASA's Safety, Environmental, and Mission Assurance Directorate (Code Q).the Government. All asbestos materials and miscellaneous debris in sealed drums shall be transported to the designated site per EPA 40 CFR 61, Subpart M guidelines. Labels and all necessary signs shall be in accordance with EPA 40 CFR 61, Subpart M, OSHA 29 CFR 1910.100, Asbestos.

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SECTION 02090

LEAD PAINT ABATEMENT/DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

- a. Contractor shall furnish all labor, materials, services, and equipment necessary for the removal and approved disposal of lead-based paint and/or items covered with lead-based paint located at the jobsite and lead-contaminated materials resulting from the work performed.
- b. This work includes manual demolition, saw-cutting, hand-tool cleaning, use of heat guns, chemical strippers, and power-tool cleaning with dust collection systems. Abrasive blasting, water blasting, dry scrapping, heat greater than 1100°F and power-tool cleaning without high efficiency particulate air (HEPA) dust collection systems shall not be used, unless pre-approved. Torch-cutting, burning, and welding within 6 in. of a material containing lead is prohibited.
- c. Work shall be performed per documents referenced herein, and with all applicable federal, state, and local regulations. Nothing specified herein shall be construed as waiving any legal requirements. All painted surfaces at NASA Ames Research Center are assumed to contain lead unless specified otherwise. Disturbance of any painted surface must comply with this specification and [APR 1700.1](#), Chapter 35.
- d. All HEPA-filtered air pressure differential machines and vacuums shall be DOP certified. This certification must accompany all HEPA filtration systems (negative air machines and vacuums) brought onto NASA property. The DOP test must have been conducted within the last 30 days, and must be retested every 30 calendar days. Copies of all DOP certifications shall be submitted to the COTR.
- e. All workers disturbing lead covered by this specification shall wear, at a minimum, half face, HEPA-filtered, negative pressure respirators.

1.2 REFERENCES

Contractor shall abide by the provisions and recommendations of the following:

U.S. DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY & HEALTH
ADMINISTRATION (OSHA)

29 CFR 1910.1025	Lead Regulations
29 CFR 1926.62	Construction Lead Regulations
29 CFR 1910.134	Respirator Regulations
	Toxic Substances Control Act (TSCA), Title 4

California Labor Code Sections 6501.5, 6501.7, 6501.8, and 6505.5

CALIFORNIA CODE OF REGULATIONS (CCR)

- Title 8, Section 5216 Lead Regulations
- Title 8, Section 1532.1 Construction Lead Regulations
- Title 8 Sections 5141 & 5144 Respirator Regulations
- Title 17 Division 1, Chapter 8 Accreditation, Certification, and Work Practices for Lead-Based Paint and Lead Hazards

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing

RESOURCE CONSERVATION RECOVERY ACT (RCRA)

Health and Safety Code Section 25914

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI Z.9.2 Fundamentals Governing the Design & Operation of Local Exhaust Systems
- National Electrical Code
- National Plumbing Code
- California Business & Professions Code Section 7058.5

1.3 SUBMITTALS

Prior to start of work, submit the following per Section 01300, Submittals:

SD-01, Data

Data, including copy of Contractor-performed risk assessment per 29 CFR 1926.62, to be approved before any reductions in controls.

SD-04, Shop Drawings

Shop Drawings, showing the layout of work areas, and emergency egress routing and exits, and showing locations of clean room/change area, shower (if any), equipment room, equipment, and negative air machines.

SD-06, Instructions

Instructions, including Material Safety Data Sheets (MSDS's) for chemicals brought onto the site.

- a. Material Safety Data Sheets (MSDS's) for chemicals brought onto the site.

- b. [Decontamination and work procedures](#) to be used by all workers and visitors.
- c. Copy of [respirator program](#) complying with [29 CFR 1910.134](#).
- d. Procedure(s) for evacuation of injured workers (aid for seriously injured workers shall not be delayed for reasons of decontamination).

[SD-08, Records](#)

- a. Documented proof that the employees have successfully completed the required training. Copy of certificates for each employee from the CA DHS approved trainer that the employee has received Lead Worker training.
- b. Documented proof that the workers have been recently fit tested for respirators within the past year.
- c. Copy of results of blood tests for lead taken within the past 6 months.
- d. Documented proof that the on-site supervisor meets the criteria for a "competent person" as set forth in [29 CFR 1926.1101](#).
- e. Copy of all applicable permits and licenses (per paragraph entitled "Permits & Licenses").
- f. Copy of medical certification of physical examination on all employees engaged in the operation clearly showing medical qualification for lead-related work and ability to wear a respirator.

[SD-20, Work Plan](#)

- a. Written plan for containment and waste removal, including the number and location of negative air machines, and quantity and location of on-site waste storage containers.
- b. Written lead compliance program per [29 CFR 1926.62](#).
- c. Copy of initial exposure assessment per [29 CFR 1926.62](#), if required to support the work plan.
- d. Description of the proposed waste disposal site (name, location, and phone number).

Provide and post in the clean room the decontamination and work procedures to be used by all workers and visitors.

Submit the following during and after the work, per Section [01300](#), Submittals.

[SD-08, Records](#)

- a. Copies of Contractor-performed air monitoring tests to be submitted with 24 hours of the sampling.
- b. Original records of "negative-air pressure" measurements in

containments from recording manometers to be submitted daily and final paperwork within five days of completion of work.

- c. Copies of all manifests for lead containing waste to be submitted within five days of completion of work. All waste shall be accompanied by certified weight slips.
- d. All updated training, medical, and fit-test documents to be submitted within 24 hours of expiration.

All other submittals shall be submitted within 5 days of project completion.

1.4 QUALIFICATIONS AND TRAINING

- a. The supervisor for the Contractor actually performing the work must be a "competent person", as defined by 29 CFR 1926.62 (b).
- b. Each worker must have received training per 29 CFR 1926.62 (1), including the wearing and fitting of respirators.
- c. The Contractor's supervisor must complete the required DHS-approved lead training course and be DHS certified. A certified supervisor must remain at the work location when work is being performed with asbestos-containing material. The DHS certification must remain valid for the duration of such work.
- d. Contractor's workers must complete the required DHS approved lead training course and be DHS certified. This certification must remain valid for the duration of the project.
- e. Necessary and proper licensing and training per the requirements and regulations of the State of California shall be a minimum requirement for workers and supervisors on this job.

1.4 SIGNS AND LABELS

- a. Provide and post adequate warning signs at designated entrances to the regulated area, as required by Cal/OSHA, Proposition 65 (Title 26, Division 21.5), and the EPA.
- b. Provide appropriate warning labels and placards pre-printed on all lead waste bags, and affix the same labels on other types of waste containers immediately after lead waste is placed in the containers.

PART 2 PRODUCTS

2.1 WORK CLOTHING

Provide for each person present at the jobsite (workers, supervisors, inspectors, and others) work clothing consisting of full body disposable coveralls, disposable head covers, boots (chemical resistant as necessary), protective gloves (chemical resistant as necessary), goggles (eye protection), and respirators. Other safety clothing shall be available as appropriate.

2.2 MISCELLANEOUS EQUIPMENT

- a. Equip all vacuum cleaners with HEPA filters meeting UL 586 requirements.

- b. All equipment brought onto NASA property must be free of visible dust and debris.
- c. All negative air machine exhaust ducting shall be wire reinforced.

PART 3 EXECUTION

3.1 REQUIREMENTS BY TYPE OF OPERATION

- a. Use chemical strippers in strict accordance with the approved manufacturer's instructions, including all recommended precautions. Caustic strippers shall not be used in occupied areas. If used, provide ventilation to remove all fumes and odors from the work area until the project is complete. Use of strippers containing volatile organic compounds shall be in accordance with BAAQMD Regulation 11, Rule 1. Use of caustic strippers containing chlorinated products is prohibited.
- b. Use respiratory protection at least as stringent as specified by [29 CFR 1926.62\(d\)\(2\)](#) "Protection of Employees during assessment of exposure," until a risk assessment demonstrating a lower hazard is approved by COTR and a DHS certified inspector.

3.2 WORK AREA ISOLATION

- a. A work area is defined as the room, corridor, or other space in which the work is being performed, from floor to ceiling, and between walls or other full-height partitions. The work area specifically includes the dumpster or other container in which unwrapped debris is to be placed and the path to that container.
- b. Establish the work area as a regulated area, with signage per [29 CFR 1926.62\(m\)](#), 8CCR 1532.1, and Proposition 65. In addition to isolation required by OSHA, use the procedures specified in the following paragraphs.
- c. Preparation
 1. Seal all critical barriers using, as a minimum, 6 mil thick fire-retardant polyethylene sheeting taped securely in place. Take care in sealing off lighting fixtures to avoid burning or melting the plastic sheeting.
 2. Turn off and tag out all air handling systems affecting the regulated area during the abatement operation (where feasible).
 3. Disconnect and tag out all electrical power in the work area, unless a GFCI-protected circuit is used at the point of connection to the electrical systems.
 4. Secure all openings into the work area to separate the work area from other occupied spaces and prevent unauthorized entry, and post proper signs at the openings.
 5. Seal HVAC ducts into the work area with at least one layer of 6 mil thick fire-rated plastic.
 6. Remove all furniture and equipment from the area as feasible, and

cover any furniture or equipment left in the work area with two layers of 6 mil thick fire-retardant plastic taped securely in place.

- d. Clean all work areas at the end of each work day.

3.3 DECONTAMINATION

- a. Provide protective clothing in accordance with 29 CFR 1926.62 (g) for all workers and visitors, including NASA lead consultant.
- b. Decontaminate personnel in accordance with 29 CFR 1926.62 (i).
- c. Provide and post in the clean room, the decontamination and work procedures to be used by all workers and visitors.
- d. Prepare and distribute procedures for evacuation of injured workers. Aid for seriously injured worker will not be delayed for reasons of decontamination. The procedure shall be submitted to the COTR for approval.
- e. Seal and clean the outside of containers so they are free of all visible dust, dirt, or debris prior to removing from the work area.

3.4 AIR MONITORING

- a. The Contractor shall be fully responsible for personal air monitoring needed to demonstrate compliance with DHS, OSHA, and CAL-OSHA regulations and standards of good practice in worker protection. The Contractor will be required to collect air samples on its work force for the duration of the project, and must obtain written approval from the COTR and the onsite Lead Professional prior to discontinuing personal air monitoring.
- b. If, at any time, the personal air samples collected inside the work area exceed the Action Level, all active abatement work shall stop immediately. The Contractor shall re-evaluate existing engineering controls and implement new, COTR-approved engineering controls in conjunction with cleaning the work area. If the Action Level is exceeded three times on the same contracted project, the Contractor shall implement the use of Type C respirators (air supplied) for all workers entering the work area.
- c. The Government may conduct area air monitoring, at its sole discretion. The techniques employed will be consistent with regulatory requirements. The number and location of air samples will be at the sole discretion of the onsite Lead Professional.

3.5 CLEANUP/CLEARANCE

- a. Properly package, label, and remove all waste containing lead from the work area to the holding area or hazardous waste bin. Remove all unnecessary equipment and materials from the work area. Allow the work area must be allowed to settle for one hour. After the area has settled, HEPA vacuum, wet wipe (with a detergent solution), and HEPA vacuum the space. The contractor will notify the Lead Professional when the work area is ready for inspection.
- b. A DHS-certified inspector will determine if clearance wipe samples are

necessary. Required clearance levels for wipe samples are:

1. 400 ug/ft² on interior surfaces
 2. 40 ug/ft² on surfaces with high potential for hand to mouth contact
 3. In child occupied facilities (the child care center), public and residential buildings, the current CA DHS, US EPA, or HUD regulations, whichever applies will be followed (excluding soil)
 4. Soil must be less than 400 ppm where children may be present
 5. Soil must be less than 1,000 ppm in other areas
- c. After all barriers/enclosures have been removed, wet clean and HEPA vacuum the surfaces/areas that were covered.
- d. If clearance samples collected in the work area do not meet the established clearance criteria, the contractor shall wet wipe and HEPA vacuum the entire work area again. A new set of clearance samples will be collected.
- e. After visual inspection and or clearance sampling indicates the remediation and cleaning is acceptable barriers and enclosures can be removed.
- 3.6 DISPOSAL
- a. Contain, remove from the surroundings, and properly handle dust, chips, and abrasive as hazardous waste. Note: if all such is contained in the HEPA vacuums, it may be removed still in the vacuums and disposed of later by the Contractor.
 - b. Other debris is unlikely to be considered as hazardous, and may be disposed as construction debris, transported in a covered container. Plastic, suits, and other protective material must be HEPA vacuumed prior to disposal.
 - c. Clean, sealed bags/containers may be stored in a holding area adjacent to the work area until a sufficient volume has accumulated for disposal, but not longer than 30 days. The holding area shall be prominently marked, and waste containers shall be covered with plastic sheeting and protected from damage.
 - d. Carefully handle lead waste containers to prevent rupture and release. Workers loading or unloading the waste shall wear approved respirators.
 - e. Contractor shall be fully responsible for all costs for lead waste characterization, profiling, and testing, and for hauling lead wastes to a designated on-site location for Government disposal. The disposal of waste in an approved landfill, in accordance with the rules and regulations of the California Department of Health Services, the Regional Water Quality Control Board, and any other applicable agencies. Removal from the site shall be by a licensed hazardous waste hauler, and the manifest shall be signed by a civil servant representative of NASA's Safety, Environmental, and Mission Assurance Directorate (Code Q).

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SECTION 02200

SITE PREPARATION AND EARTHWORK
08/06

PART 1 GENERAL

1.1 SUMMARY

This section specifies work involving site preparation and earthwork, including definitions of soils materials used under other sections of this specification. It does not include actual installation of site utilities.

1.2 REFERENCES

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO T2 Sampling of Aggregates

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D1557 Laboratory Compaction Characteristics of
Soil Using Modified Effort (56,000
ft-lbf/ft)

ASTM D2487 Classification of Soils for Engineering
Purposes (Unified Soil Classification
System)

ASTM D2922 Density of Soil and Soil-Aggregate in
Place by Nuclear Methods (Shallow Depth)

ASTM D3017 Water Content of Soil and Rock in Place by
Nuclear Methods (Shallow Depth)

U.S. DEPARTMENT OF LABOR, OCCUPATIONAL SAFETY AND HEALTH
ADMINISTRATION (OSHA)

OSHA 29CFR1926 Safety and Health Standards for the
Construction Industry

AMERICAN CONCRETE INSTITUTE (ACI)

ACI229R - 94 Guidance on using flowable fill mixtures

1.3 SUBMITTALS

Submit the following per Section 01300, Submittals:

SD-13, Certificates

Certificates, for manufactured materials

SD-14, Material Samples

Material Samples, of soil materials. Two 30 lbs sacks of each material, submitted at least 10 days in advance of intended use.

SD-18, Record of Existing Conditions

SD-18, Records

Records, of quantity and location of groundwater disposal each day. Provide report weekly.

1.4 QUALITY CONTROL

- a. Testing Service - Soil testing service will be provided by the Government. Submit samples of materials proposed for use in project, including in-situ materials.
- b. Testing Requirements

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Soil materials	Sampling	AASHTO T2	One per type and source, whenever there is any apparent change.
	Classification	ASTM D2487	
	Moisture-density relations	ASTM D1557, Method D	
Fill and backfill	Density	ASTM D2922	Three per lift in-place or layer
	Moisture Content	ASTM D3017	
Spoil	Fuel/solvent contamination	EPA Methods	One per 99 cy ³ , at least one per site, whenever contamination is known or suspected.

c. Evaluation of Test Results

- 1. Test spoil. Consider spoil a satisfactory fill/backfill material unless otherwise determined by COTR. If COTR determines that spoil is unsuitable because of contamination by fuel or solvents, use borrow material and haul unsatisfactory spoil to a designated site on Ames Research Center; the cost thereof will be borne by the Government.
- 2. Results of soil-in-place tests are considered satisfactory if:
 - a) Average density equals or exceeds that specified
 - b) No density test is less than 2 percent below specified density
 - c) Moisture content tests are within 2 percent of optimum

1.5 DEFINITIONS

- a. Subgrade - Top surface of a backfill or fill, or uppermost surface of an excavation, graded to conform to required subgrade elevation, and compacted.
- b. Suitable Topsoil - Friable clay loam surface soil to be used as a base for grass planting. Occurs as a thin soil layer covering naturally well-drained land covered by a heavy growth of grass, or which has been covered with a heavy growth of grass during the latest growing period before start of construction. Free of subsoil, clay lumps, brush, weeds, and other litter, and free of stones, stumps, objects larger than 2 in. in any dimension, roots, and other objectionable material.
- c. Degree of Compaction - Expressed as a percentage of maximum density obtained by test procedure in [ASTM D1557](#), Methods B or D.
- d. Satisfactory Soil Materials - Those meeting classification for intended use; are uncontaminated by fuel and solvents; and are free of organic matter, trash, stones greater than 3 in. in any dimension, and any other deleterious substances.
- e. Spoil - Material, below level of topsoil, removed from excavations on jobsite.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

Conform to following designation:

<u>MATERIAL DESIGNATION</u>	<u>MAXIMUM PARTICLE SIZE, in.</u>	<u>UNIFIED SOIL CLASSIFICATION</u>
Borrow	3	SW, SW-SM, SW-SC, SM, SC, GW-GM, GW-GC, GM, GC
Sub-base	1.5	SW, SW-SM, SW-SC, GW, GW-GM, GW-GC
Base	1.5	GW-GM, GW-GC
Sand, bedding material	0.2	SP
Gravel, filter material	0.5	GP (less than 5% passing 0.2 sieve)
Clay, impervious fill	0.02	CL, CM

Refer to project Geotechnical Study for NASA Ames N234A SVS Deaerator/Feedwater Tank Replacement project dated February, 2010, prepared by Fugro West, Inc., for acceptable material for engineering fill.

2.2 USE OF SOIL MATERIALS

Refer to project Geotechnical Study by Fugro West, Inc., dated February, 2010.

PART 3 EXECUTION

3.1 GENERAL

- a. Before earthwork is started, carefully verify location of underground utilities by hand methods. Protect from damage utilities to be left in place.
- b. All earth disturbance shall be done with sufficient wetting of the soil to prevent visible airborne dust, thereby controlling silica dust inhalation.
- c. Where excavations cut through paved areas, saw-cut pavement to provide a clean edge. Pavement removed from excavation site is classified as debris - dispose of this pavement legally. Patch resulting cut with similar material in accordance with Section 02500, Asphalt-Concrete Paving and Markings, or Section 03300, Cast-in-Place Concrete, as applicable.
- d. Pile spoil backfill in an orderly manner, shape to drain, and place at 2 ft minimum from excavations to prevent overloading, slides, and cave-ins.
- e. Protect trenches and excavations from inflow of surface water. Prevent flooding of jobsite and surrounding area.
- f. Keep contaminated soil segregated from uncontaminated soil throughout course of Work.

3.2 SURFACE PREPARATION

- a. Remove trees, stumps, roots, brush, and other vegetation in areas to be cleared, except those indicated or directed to be left standing. Trees to be left standing - Trim of dead branches 1.5 in. diameter or larger and of live branches to indicated height; neatly cut close to bole of tree or main branches. Paint cuts with tree-wound paint. Protect trees and vegetation to be left standing by erecting barriers or by other means as required.
- b. Remove stumps, roots, and organic or other debris to a minimum depth of 8 in. below surface level of original ground. Do not use mechanical grubbing equipment inside drip lines of trees indicated to remain standing.
- c. Strip topsoil from surface of areas to receive fills or embankments, or to be excavated. Transport topsoil to, and stockpile in, designated storage areas.
- d. Fill depressions resulting from grubbing operations with acceptable backfilling material, unless further excavation is required. Before filling, ensure that subgrade surfaces of depressions are free of standing water, frost, or frozen material. Remove unsatisfactory soil materials.

3.3 EXCAVATION

- a. Shoring and Bracing
 1. Shore excavations 5 ft or more in depth. Shore excavations when

sides are subjected to vibrations from vehicular traffic, from operation of machinery, or from any other source. Shore and brace trenches over 2 ft in depth that will remain open for seven days or more. Shore and sheet any trench that has been open seven days, regardless of how much longer that trench is to remain open. Conform to OSHA 29 CFR Part 1926.652(c). For excavations over 12 ft in depth, ensure that shoring is designed by a California-licensed civil engineer, and submit design to COTR for approval.

2. Trench shields and backsloping are not acceptable in any developed area of Ames Research Center.
3. Wherever subsequent removal of sheet piling would permit lateral movement of soil under adjacent structures, use and permanently leave in place steel sheet piling or pressure-treated timber sheet piling, cut off as required.

b. Dewatering

1. Do not allow water to accumulate in excavations. Provide a dewatering system, as required, to convey water to approved disposal areas. Water from excavations is not allowed into the storm drain system. Provide and maintain temporary drainage ditches and other diversions as necessary outside of excavation limits. Dewatering system and method of disposal requires approval by NASA Safety Office. Continue dewatering until construction subjected to water pressure has obtained full-specified strength and backfill is completed.
2. Groundwater in area of work may be contaminated with petroleum products. Provide a sample of groundwater for analysis by the Government at least 10 days before starting dewatering operations. Depending on results of this analysis, groundwater may be disposed of into sanitary sewer or into Government-provided decontamination equipment. In either case, keep detailed records of quantity, by date, of groundwater removed, and provide a copy of these records to the Government with each payment request.
3. Groundwater may be encountered at approximately 4 ft to 9 ft below surface in developed areas of Ames-Moffett, and 12 inches to 3 ft below surface in undeveloped areas, unless otherwise indicated.
4. Do not use trench excavations for utilities as temporary drainage ditches.

c. Excavation for Structures

1. Conform to dimensions and elevations indicated within a tolerance of +/-1.2 in., and extend a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services and other construction indicated, and for inspection.
2. In excavating for footings and foundations, do not disturb bottom of excavation.
3. For pile foundations, stop excavation at an elevation 6 in. to 1 ft above bottom of footing before piles are driven. After pile

driving has been completed, remove loose and displaced material and perform excavation to final grade, leaving a solid bed to receive concrete.

- d. Excavation of Ditches, Gutters, and Channels - Accomplish excavation by cutting accurately to cross sections, grades, and elevations indicated. Backfill excessive open-ditch or gutter excavation with approved materials to grade at no additional cost.
 - e. Trench Excavation
 - 1. Provide side slopes of trenches as nearly vertical as practicable. Grade bottoms of trenches accurately, at an elevation allowing for specified bedding or filter material. Dig bell holes and depressions for joints after trench bottom has been graded, and only to length, depth, and width required to make joint. Except as specified for wet or otherwise unstable material, backfill overdepths with materials specified for backfilling lower portion of trenches.
 - 2. Sequence trenching for underground utilities to minimize time a trench is open. If any area of trench is left open more than seven days, desist from further trenching until existing trenches are completely backfilled.
 - f. Excavation for Subdrainage System - Provide excavation for foundation subdrainage system, except for footing drains, with vertical sides for a distance of at least twice pipe diameter above bottom of pipe; make excavation suitably wide to allow 6 in. to 9 in. clear on each side of pipe. Grade bottom of trench excavations to obtain required slope, and tamp to provide a firm bed for drain pipe bedding material.
 - g. Removal of Unsatisfactory Soil Materials - Excavate unsatisfactory soil materials that extend below required elevations to depth directed by COTR.
 - h. Unauthorized Excavation
 - 1. Unauthorized excavation is removal of materials beyond indicated subgrade elevations or side dimensions specified without specific direction. Replace unauthorized excavation material as specified at no additional cost.
 - 2. Fill unauthorized excavation under foundations or retaining walls by lowering bottom elevation of footing or base to excavation bottom without altering approved top elevation. Elsewhere, backfill unauthorized excavations and compact as specified for authorized excavations of same classification.
 - i. Removal of Existing Underground Utilities - Demolish and remove from excavation existing underground utilities indicated to be removed. Permanently close open ends of existing underground utilities with masonry bulkheads, threaded galvanized metal caps, plastic plugs, or other suitable, approved method. Wood plugs are not permitted.
- 3.4 FILLING, BACKFILLING AND COMPACTION
- a. Backfill excavations as promptly as work permits, but not until completion of following:

1. Removal of concrete formwork, shoring, and bracing.
2. Completion of concrete waterproofing and subdrainage system.
3. Inspection, testing, and approval of underground utilities, subdrains, and other construction.
4. Removal of trash and debris.
- b. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials before placement of fill material. Sloped surfaces steeper than 1:4 (vertical:horizontal) - Plow, strip, or break up so that fill material will bond with existing material. Scarify, condition, and compact existing ground surface to required depth (minimum 6 in.) and percent of maximum density.
- c. Place backfill and fill material in layers of maximum 8 in. in loose depth; moisten or aerate as necessary to provide optimum moisture content; and then compact to specified density. Do not place backfill or fill material on surfaces that are muddy, frozen, icy, or contain frost.
- d. Bring up backfill and fill materials adjacent to structures evenly around structure. Compact with power-driven hand tampers within a horizontal distance equal to depth of backfill or fill.

3.5 GRADING

- a. Uniformly grade areas within limits of grading, including adjacent transition areas. Ensure that finished surface is smooth and even, compacted, is free of voids, has uniform levels or slopes, and is 1 in. maximum above or below indicated subgrade elevations (except below walks where the limits are 0 above and 1 in. below). Maximum deviation of 1 in. when tested with a 10 ft straightedge.
- b. Hand grade areas adjacent to structure to drain away from structure and to prevent ponding of water after rains.

3.6 MAINTENANCE

Protect newly graded areas from traffic and erosion, and maintain them free of trash and debris. Where disturbed by subsequent construction operations or adverse weather, scarify, reshape, and compact surface as specified to required density before proceeding with further construction.

3.7 DISPOSAL OF EXCESS AND WASTE MATERIALS

Waste soil that is clean and meets the requirements for acceptable soil material may be transported to and spread, as directed, on Government property. Waste soil that is clean, except for contamination by petroleum products - dispose of on Government property as directed by COTR. Other waste soil - legally dispose of off Government property. Other waste materials, trash, and debris - remove from Government property and legally dispose of.

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SECTION 02500

ASPHALT-CONCRETE PAVING AND MARKINGS
08/06

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for asphalt concrete paving.

1.2 REFERENCES

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M247 Glass Beads Used in Traffic Paint

AASHTO M248 Ready-Mixed White and Yellow Traffic Paints

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D692 Coarse Aggregate for Bituminous Paving
Mixtures

ASTM D1073 Fine Aggregate for Bituminous Paving
Mixtures

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS)

CalTrans Spec Standard Specification

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Manufacturer's Catalog Data

Manufacturer's Catalog Data for paint and other manufactured materials.

SD-05, Mix Designs

Mix Designs for asphalt concrete mixes, including compaction curve.

SD-13, Certificates

Certificates for asphalt binder, prime coat and tack coat.

SD-21, Delivery Dockets

Delivery Dockets for asphalt concrete.

PART 2 PRODUCTS

2.1 ASPHALT CONCRETE MATERIALS

- a. Asphalt Concrete - Type B, $\frac{1}{2}$ in. maximum, medium gradation, 1992 CalTrans Spec Section 39, Asphalt Concrete.
- b. Asphalt Binder - Steam-refined paving asphalt, Grade AR 4000, 1992 CalTrans Spec Section 92, Asphalts.
- c. Prime Coat - Liquid asphalt, Grade SC-70, 1992 CalTrans Spec Section 93, Liquid Asphalts.
- d. Tack Coat - Asphalt emulsion, RS 1, 1992 CalTrans Spec Section 94, Asphaltic Emulsions.
- e. Coarse Aggregate - ASTM D692. Fine aggregate - ASTM D1073. Sand equivalent value: 30, minimum.

2.2 PAVEMENT MARKING

- a. Paint - AASHTO M248, Type S. Parking lanes and crosswalks white, and traffic lanes yellow.
- b. Glass Beads for Reflectorized Paint - AASHTO M247, Type 1.

PART 3 EXECUTION

3.1 GENERAL

a. Weather Limitations

1. Apply bituminous prime and tack coat only when ambient temperature in shade is above 50°F and when temperature has not been below 35.6° F for 12 hours immediately before application. Start application when aggregate base course is dry or contains moisture not in excess of amount permitting uniform distribution and required penetration.
2. Construct asphalt concrete courses only when ambient temperature is above 39°F and underlying base course is dry.
3. Paving and marking operations must be suspended if rain is forecasted prior to materials being allowed to sufficiently dry.

b. Transportation of Mixtures

1. Transport asphalt-concrete mixtures from mixing plant to jobsite in trucks with tight, clean, smooth beds coated with a minimum amount of a concentrated solution of hydrated lime and water to prevent adhesion of mixture to truck beds.
2. Cover each load of mixture with canvas or similar material sufficiently large and heavy to retard heat loss and to protect mixture from weather.
3. In cool weather or for long hauls, insulate entire contact area of each truck bed. Securely fasten covers.

4. Deliver mixture so that minimum temperature of mixture at time of dumping into paver is 300°F.
5. Ensure that trucks do not travel on mixture until compaction is complete and until asphalt concrete pavement surface will support traffic without measurable deformation.

3.2 PREPARATION

- a. Surface Preparation - Remove loose or other objectionable materials from aggregate base course surface or other contact surface immediately before applying bituminous prime coat.
- b. Priming Base Course Surface
 1. Uniformly apply bituminous prime coat to prepared base course surface. Rate of application: 26.5 fl. ounce/yd² to 53.0 fl. ounce/yd² of surface. Temperature of bituminous material at time of application: 106°F to 180°F.
 2. Squeegee excess prime coat material from surface. Treat areas missed by bituminous prime coat distributor with prime coat material using hand sprayers.
 3. After applying prime coat material, allow surface to dry undisturbed for 48 hours, minimum. Blotting prime coat with fine aggregate is not permitted.
- c. Priming Other Contact Surfaces
 1. For contact surfaces of curbs, gutters, manholes, and other structures projecting into or abutting concrete pavement apply a thin, uniform coating of bituminous tack coat material before placing asphalt-concrete mixture.
 2. After applying tack coat, allow surface to dry until suitably tacky to receive asphalt-concrete mixture. Squeegee excess tack coat material from surface.

3.3 PLACING ASPHALT-CONCRETE

- a. Place asphalt-concrete mixture on prepared surface, spread uniformly, and strike off. Place asphalt-concrete in layers of approximately equal thickness; 2 in. maximum thickness of layer after compaction. When width of paved area is less than 5 ft (such as in trench repair or patching), material may be placed in one course.
- b. Pavement Placing - Begin placing along centerlines of areas to be paved on a crowned section, at high side of a section with a one-way slope, and in direction of traffic flow. Place mixture for each course in strips 10 ft wide minimum. Progressively place strips after rolling first strip. Extend rolling to overlap preceding strips. Place continuously.
- c. Hand Placing
 1. In areas where machine spreading is not practicable, spread and finish with heated hand tools.

2. Dump mixture on approved dump boards, and distribute into place in a uniformly loose layer of a thickness that will, when compacted, conform to required grade and thickness. Dump mixture at a rate that can be handled properly by shovelers and rakers.

d. Joints

1. Ensure that joints have same texture, density, and smoothness as other sections of course. Make joints between old and new pavements, or between successive days' work, so as to ensure a continuous bond between old and new sections of pavement.
2. Offset transverse joints in succeeding courses 2 ft minimum. Cut back edge of previously placed course to expose an even vertical surface over full thickness of course.
3. Offset longitudinal joints in succeeding courses 6 in. minimum. When edges of longitudinal joints are irregular or do not conform to specifications, cut back edge to expose an even vertical surface over the thickness of course.

3.4 COMPACTION

- a. Start compaction as soon after placing as asphalt-concrete mixture will bear weight of roller without undue displacement.
- b. During rolling, keep wheels moist with minimum amount of water required to avoid picking up asphalt-concrete mixture.
- c. In places not accessible to the rollers, compact mixture with hot hand tampers.
- d. Start rolling longitudinally at extreme sides of lanes, and proceed towards center of pavement, except on superelevated curves. On superelevated curves, start rolling on low side and progress to high side, overlapping on successive trips by at least one-half width of rear wheel of roller.
- e. Make alternate trips of roller of slightly different lengths.
- f. Ensure that rollers move at a slow but uniform speed, with drive roll or wheel nearest paver. Maximum speed: 3 mph for steel-wheeled rollers, 5 mph for pneumatic-tired rollers.
- g. Rolling
 1. Initial rolling - Perform immediately after rolling longitudinal joints and edges. Operate rollers as close to paver as possible without causing undue displacement. Make preliminary tests of crown, grade and smoothness immediately after initial rolling.
 2. Second rolling - Perform as closely as possible after initial rolling, while mixture is hot and suitable for proper compaction. Make rolling continuous (at least three complete coverages) until mixture has been compacted. Undue displacement is not permitted.
 3. Finish rolling - Perform while mixture is suitably warm for removal of roller marks. Continue rolling until roller marks are

eliminated and course has specified density.

h. Patching Deficient Areas

1. Saw-cut and remove asphalt concrete mixtures that become mixed with foreign materials or that are defective (such as low areas or "bird-baths"), replace with fresh asphalt-concrete mixture to obtain required grade and smoothness for finished surface, and compact to specified density.
2. Remove pavement in deficient areas to full thickness of asphalt-concrete course, cut sides perpendicular and parallel to direction of traffic, and make edges vertical. Spray edges with bituminous tack coat material.
3. Skin patching an area that has been rolled is not permitted.

- i. Protection of Pavement - After final rolling, do not allow vehicular traffic on pavement until pavement has cooled and hardened, and in no case sooner than 6 hours.

3.5 QUALITY CONTROL

- a. The Government may extract 3 in. diameter pavement specimens of each completed asphalt concrete. Repair test holes. Ensure that thickness does not vary from plan thickness by more than $\frac{1}{8}$ in. for base course and $\frac{1}{8}$ in. for surface course.
- b. Finished surface of each asphalt-concrete course will be tested for smoothness with a 10 ft straightedge applied parallel with, and at right angles to, centerline of paved area. Maximum allowable variation from straightedge: $\frac{1}{8}$ in. for lower course surface, $\frac{1}{16}$ in. for wearing course surface.
- c. Crown of each asphalt-concrete course will be tested for conformance to required cross section with a crown template centered on, and at right angles to, centerline of crown. Maximum allowable variation of finished crown surface from crown template: $\frac{1}{8}$ in. for each asphalt-concrete course.
- d. Ensure that final surface has a uniform texture and conforms to required grade and cross section. Immediately correct low or defective areas by cutting out and replacing faulty areas.

3.6 PAVEMENT MARKING

- a. Cure new pavement surfaces for 7 days before applying marking materials. Where oil or grease are present on old pavement, scrub affected areas with approved detergent or degreaser, and rinse thoroughly.
- b. Apply paint at a rate recommended by manufacturer, when air and pavement temperatures are between 39°F and 95°F, and maximum relative humidity is 85 percent for one hour after application.
- c. Where reflectorized paint is specified, dispense glass beads uniformly at a rate of 12.0 lbs/gallon of paint.
- d. Markings - Sharply outlined and of uniform thickness. Strip widths -

as indicated. If discoloration of paint occurs due to bleeding of bitumen, apply paint in two coats. Place traffic control markers along newly painted lines to protect lines from damage. Rinse water shall be collected and disposed of properly.

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SECTION 03300

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08/06

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SECTION 03300

CAST-IN-PLACE CONCRETE
08/06

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for normal-weight Portland cement concrete work, including formwork, reinforcement, accessories, and finishing.

1.2 REFERENCES

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 304	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305	Hot Weather Concreting
ACI 306	Cold Weather Concreting
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 318M	Building Code Requirements for Reinforced Concrete
ACI 347	Formwork for Concrete

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A185	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A615M	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C33	Concrete Aggregates
ASTM C94	Ready-Mixed Concrete
ASTM C150	Portland Cement
ASTM C260	Air-Entraining Admixtures for Concrete
ASTM C309	Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Chemical Admixtures for Concrete
ASTM C618	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in

Portland Cement Concrete

U.S. ARMY CORPS OF ENGINEERS, CONCRETE RESEARCH DIVISION (CRD)

CRD-C 572

Polyvinylchloride Waterstops

1.3 SUBMITTALS

Refer to Section 01300 , Submittals. Submit the following:

SD-04, Shop Drawings

Shop Drawings, for concrete reinforcement, as necessary to indicate dimensions and details for fabrication and placing of reinforcement and accessories.

SD-05, Mix Designs

Mix Designs, for each concrete mix to be used.

SD-06, Manufacturer's Instructions

Manufacturer's Instructions, for admixtures, joint fillers, curing compounds and floor hardeners.

SD-10, Test Reports

Mill test reports for reinforcement.

SD-14, Samples

Samples, for exposed-aggregate.

SD-21, Delivery Dockets

Delivery Dockets, for ready-mixed concrete.

1.4 QUALITY CONTROL

- a. Conform to **ACI 318**.
- b. Ready-mixed Concrete - Manufactured and delivered by an experienced ready-mix concrete manufacturer, in accordance with **ASTM C94**.
- c. Job-mixed Concrete Batching and Mixing - **ACI 304**.
- d. All the inspection and continuous inspection shall be done by an independent qualified testing agency and qualified inspectors at the expense of the Contractor. The inspection includes formwork, reinforcement, and embedded items before concrete placement.
- e. The Government shall be notified in advance to witness all the work, inspect formwork, reinforcement, and embedded items before concrete placement. Correct discrepancies before placing concrete in forms.
- f. Schedule concrete placement with the inspector and Government at least 24 hours in advance. The inspection agency will perform quality-control testing during construction and Government will witness. Slump tests are required for each load, each time water is

adjusted and for each set of compression test cylinders. Four cylinders will be taken for each day or for each 52 cy³ of concrete placed, whichever is more stringent.

- g. Immediately desist from placing, and remove, any concrete found to be not in conformance with specifications.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

- a. Aggregates - **ASTM C33**; $\frac{3}{4}$ in. maximum size.
- b. Cement - **ASTM C150**, Type II. Use one uniform brand and type of cement for concrete with exposed finished surface.
- c. Air-entraining Admixtures - **ASTM C 260**.
- d. Water-reducing, Retarding, and/or Accelerating Admixtures - **ASTM C494**. Do not use calcium chloride.
- e. Pozzolans - **ASTM C618**, Class C or Class F with 4 percent maximum loss on ignition and 20 percent maximum cement replacement by weight.
- f. Minimum Compressive Strength: 3000 psi at 28 days. Maximum slump: 4 in. +/- $\frac{1}{2}$ in. Maximum water/cement ratio: 0.55.

2.2 REINFORCEMENT

- a. Steel Bars - **ASTM A615M**, Grade 60, except that #3 bars may be Grade 40.
- b. Welded Wire Fabric - Cold drawn steel wires welded at intersections, **ASTM A185**. Use #3 wires at 6 in. on center, each way. Unless specifically required otherwise, do not use rolled type welded wire fabric.

2.3 FORM MATERIALS

- a. Forms - **ACI 347**; of wood, steel, or other approved material. Type, size, shape, quality, and strength of form materials are subject to approval by COTR.
- b. Form Oil - Clear compound that will not discolor or injure concrete.
- c. Supports for Rebar - Plastic. Ensure that supports required to be of steel are galvanized.

2.4 WATERSTOPS

Flat dumbbell type; polyvinylchloride; minimum 0.20 in. thick for widths up to 5 in.; minimum $\frac{3}{8}$ in. thick for widths over 5 in.; **CRD-C 572**.

2.5 CHEMICAL FLOOR HARDENER

Colorless aqueous solution containing a blend of magnesium fluorosilicate and zinc fluorosilicate combined with a wetting agent. Fluorosilicate solution 2.41 lbs/gallon minimum. An approved proprietary chemical hardener may be used if delivered ready for use in manufacturer's original containers.

2.6 CURING COMPOUND

Spray-applied, white-pigmented, [ASTM C309](#).

PART 3 EXECUTION

3.1 FORMWORK

- a. Conform to [ACI 347](#). Ensure that forms are true to line and grade, mortar-tight, and sufficiently rigid to prevent objectionable deformation under load. Ensure that form surfaces for permanently exposed faces are smooth and free of irregularities and holes. Chamfer exposed joints and exposed edges. Recess internal ties [1 in.](#) minimum from final exposed concrete surfaces.
- b. Forms for Exposed Surfaces - Coat with a nonstaining form release coating shortly before placing concrete. Do not allow form release agent to come into contact with reinforcement or existing concrete to be bonded. Forms for unexposed surfaces may be wetted instead of being coated immediately before placing concrete, except in freezing weather.

3.2 STEEL REINFORCEMENT

- a. Shop fabricate in accordance with [ACI 318](#), including details, bends and splices.
- b. Ensure that reinforcement is free of loose, flaky rust and scale, and of oil, grease, or other coatings that may reduce bond with concrete.
- c. Secure reinforcement in place with metal or concrete supports, spacers, or ties. Minimum concrete cover at surfaces exposed to earth: [3 in.](#) Minimum concrete cover at other surfaces: [2 in.](#), unless otherwise indicated.
- d. Wire Mesh Reinforcement - Place to full width and length of slabs and walks (less [4 in.](#)), at mid-depth, and support at [3 ft](#) maximum. Lap mesh minimum one full mesh plus [2 in.](#) Fasten laps at each edge.
- e. Place rod reinforcing as indicated; conform to [ACI 315](#) and [ACI 318](#).
- f. Terminate reinforcement [2 in.](#) +/- $\frac{1}{2}$ in. from edges and from each side of expansion and construction joints.

3.3 EMBEDDED ITEMS

Before placing concrete, firmly secure and fasten in place embedded items. Ensure that embedded items are free of oil, loose coatings of rust, paint and scale. Embedding of wood in concrete will be permitted only when specifically authorized or directed.

3.4 CONCRETE PLACEMENT

- a. Convey concrete from mixers to forms as rapidly as practicable by methods that prevent segregation or loss of ingredients. Hot weather concreting - [ACI 305](#). Cold weather concreting - [ACI 306](#).
- b. Place concrete within 90 minutes after mixing. Place on clean, damp surfaces free of ice, frost, mud, debris, or objectionable coatings.

Consolidate with internal mechanical vibrators supplemented by handspading and tamping. Work into corners and angles of forms and around reinforcement and embedded items without permitting materials to segregate.

- c. Place concrete in horizontal layers 2 ft thick maximum, at a rate that will prevent formation of cold joints. Place slabs in one lift.
- d. Screed and float concrete before bleeding begins.

3.5 JOINTS

- a. Construct joints true to line, with faces perpendicular to surface of concrete. Make longitudinal joints parallel to centerlines of walks and slabs. Make transverse joints perpendicular to centerline. Joint locations - Maximum variation of 1/8 in. from true position. Make edges of joints on adjacent sections flush.
- b. Do not saw-cut joints, unless otherwise indicated. Make saw-cut joints square-edged. Remove slurry from joints and adjacent concrete before it dries.
- c. Construct expansion joints in slabs and walks at a maximum distance of 30 ft on center. Fill expansion joints with joint fillers. Ensure that expansion joints in walks coincide with those in adjacent curbs and gutters.
- d. Construct isolation joints in slabs and walks to full depth where these slabs and walks abut curbs, buildings, manholes, utility poles, steps, or other fixed structures.
- e. Extend premolded joint fillers for expansion and isolation joints full width and depth of joint. Make top 1/2 in. to 1 in. below finished surface. Attach joint fillers securely to prevent displacement during concrete placement.
- f. After concrete is cured, clean joints of foreign matter (including membrane-curing compound); then immediately seal joints with specified sealer and completely fill joint. Clean spills immediately; protect joints from traffic until cured.
- g. Install control joints in slabs, curbs, and gutters at maximum intervals of 10 ft; and in walks at maximum intervals of 5 ft. Form joints with a jointing tool, preformed removable strips, or other approved means. Extend control joints into concrete for a least 0.25 of depth, and make approximately 1/16 in. wide.

3.6 FINISHING

- a. Do not begin finishing operations until surface water has disappeared. Use of dry cement as an absorptive material is prohibited.
- b. Exposed aggregate surfaces - Cover entire surface uniformly with approved aggregate. Evenly spread aggregate, tamp, and level with a wooden screed or float.
- c. Steel trowel finish interior slab surfaces and slab surfaces that are to be covered with resilient flooring, paint, or other finish coating systems. Start final troweling when a ringing sound is produced as

trowel is moved over surface. Consolidate surface by hand troweling.

- d. Broom finish slab surfaces that form final walking surfaces. Provide finish with 0.063 in. to 0.12 in. amplitude. Make finish straight and perpendicular to edges of slab.
- e. Wood float finish other unformed surfaces.
- f. Finish edges, including those at formed joints, with a 0.12 in. radius edging tool, and remove edger marks.
- g. Ensure that finished surfaces are free of trowel, edger, and uneven broom marks are uniform in texture and appearance, and are plane to a tolerance of 1:500 when checked with straightedge placed on surface in any direction. Remove surface defects by grinding.

3.7 STRIPPING AND CURING

- a. Remove forms carefully to prevent damage to concrete.
- b. Do not remove forms before expiration of following minimum times:
 - 1. Arches, beams, and deck-type slabs 144 hours
 - 2. Columns, walls and steps 48 hours
 - 3. Conduit in open cut 72 hours
 - 4. Ground slabs, curbs, and walks 24 hours

3.8 CURING

- a. Begin final curing immediately after removal of forms (if at less than 7 days). Adequately protect concrete from damage until fully cured.
- b. Cure concrete by an approved method for 7 days minimum. Use moist curing, moisture retaining cover, membrane curing, or combinations thereof. Moist curing is keeping surface of concrete wet, or covering with absorptive cover saturated and kept wet. Moisture-retaining cover curing is covering concrete surfaces with a continuous impermeable cover, or leaving formed surfaces in forms. Membrane curing is applying specified membrane-forming curing compound to damp concrete surfaces as soon as moisture film has disappeared at a rate determined by manufacturer.

3.9 CHEMICAL-HARDENER TREATMENT

Apply liquid-chemical floor hardener where indicated after curing and drying concrete surface. Dilute liquid hardener with water and apply in three coats at a rate determined by manufacturer. First coat is one-third strength, second coat one-half strength, and third coat two-thirds strength. Apply each coat evenly and allow to dry for 24 hours between applications. Apply proprietary chemical hardeners in accordance with manufacturer's printed instructions.

3.10 REPAIR OF FORMED SURFACES

Repair formed surfaces exposed to view, or that will be in contact with water or earth, immediately after removal of forms. Repair defective

concrete, voids left by removal of tie rods, and ridges and local bulging on concrete surfaces. Fill voids left by removal of tie rods with dry-patching mortar. Repair defective concrete by cutting out unsatisfactory material and placing new concrete secured with keys, dovetails, or anchors. Excessive rubbing of formed surfaces is not permitted.

3.11 CONCRETE SAMPLING AND TESTING

- a. Slump Tests - Performed for each truckload of concrete, each time quantity of water is adjusted, and for each set of compression test cylinders.
- b. Compression Test Cylinders - Three taken each day or for each 50 cy3 of concrete placed. Tested one at 7 days, one at 14 days, and one at 28 days.

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SECTION 05100
STRUCTURAL STEEL
08/06

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for structural steelwork, including rolled shapes, welded plate, and other items as indicated.

1.2 REFERENCES

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC M013	Detailing for Steel Construction
AISC M014	Engineering for Steel Construction - A Source Book on Connections
AISC M016	Manual of Steel Construction - Allowable Stress Design
AISC S303	Code of Standard Practice for Steel Buildings and Bridges
AISC S329	Allowable Stress Design Specifications for Structural Joints Using ASTM A325 or A490 Bolts

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B.18.22M	Plain Washers
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A36	Carbon Structural Steel
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A108	Steel Bars, Carbon, Cold Finished, Standard Quality
ASTM A148M	Steel Castings, High Strength, for Structural Purposes
ASTM A153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A242M	High-Strength Low-Alloy Structural Steel
ASTM A307	Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength

ASTM A325	High-Strength Bolts for Structural Steel Joints
ASTM A500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A514M	High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
ASTM A525M	General Requirement for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A668M	Steel Forgings, Carbon and Alloy, for General Industrial Use
ASTM A759	Carbon Steel Crane Rails
ASTM B695	Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM C150	Portland Cement
ASTM C404	Aggregates for Masonry Grout
ASTM C658	Chemical-Resistant Resin Grouts for Brick or Tile
ASTM E164	Ultrasonic Contact Examination of Weldments
ASTM E709	Magnetic Particle Examination
ASTM F959	Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

AMERICAN WELDING SOCIETY, INC. (AWS)

AWS A2.4	Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS A5.5	Low Alloy Steel Covered Arc Welding Electrodes
AWS D1.1	Structural Welding Code - Steel

US ARMY CORPS OF ENGINEERS, CONCRETE RESEARCH DIVISION (CRD)

CRD-C621	Nonshrink Grout
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STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP3	Power Tool Cleaning
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1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Manufacturer's Catalog Data

Manufacturer's Catalog Data for bolts, nuts, washers, paint, and grout.

SD-04, Shop Drawings

Detail drawings in accordance with AISC M013, AISC M014 and AISC M016. Use standard welding symbols conforming to AWS A2.4. Include substitution of sections or modification of details, or both, and reasons for action taken. Indicate members and connection areas not to be shop painted, sequence of erection, temporary shoring and bracing, and detailed sequence of welding, including each welding procedure required.

SD-06, Manufacturer's Instructions

Manufacturer's Instructions for load-indicating washers.

SD-10, Test Reports

Test Reports for welder qualification tests, structural steel, bolts, nuts and washers.

SD-20, Welding Procedures and Qualifications

Include type of welding and positions for which each operator is qualified, code and procedure qualified under, date qualified, and firm and individual certifying qualification tests.

1.4 QUALIFICATIONS

- a. Structural steel fabrication and erection - Performed by an organization experienced in structural steelwork similar to work specified herein.
- b. Welders - Certified to have been qualified by tests in accordance with AWS D1.1 or under an equivalent approved qualification test.
- c. Perform tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, perform immediate retest of two test welds and ensure that each test weld passes. Failure in the immediate retest requires that welder be retested after further practice or training, and that a complete new set of test welds be made.

1.5 FABRICATION REQUIREMENTS

- a. Unless otherwise indicated, AISC M016, AISC S303 and AISC S329 govern work.
- b. Design of members and connections for any portion of structure not indicated - Completed by fabricator and indicated on detail drawings.
- c. Substitution of sections or modification of details - Submit with detail drawings for approval, and indicate reasons for action taken.
- d. Fabricate and assemble structural steel in shop to greatest extent possible. Parts not assembled in shop - Secure by bolts for shipment.

- e. Splices of members are permitted only where indicated. Splices not indicated are subject to approval. Field splices in compound joints are not permitted.
- f. Tolerances in fabrication and erection - Conform to [AISC S303](#).
- g. Connections
 - 1. One-sided or other types of eccentric connections are not permitted, unless indicated and approved.
 - 2. Shop connections - Welded unless otherwise indicated.
 - 3. Field connections - Bolted, except where welded connections are indicated, as follows:
 - a) [ASTM A325](#) high-strength threaded fasteners - Use for bolted connections, except where otherwise specified.
 - b) [ASTM A307](#) low carbon steel threaded fasteners - May be used only for bolted connections of secondary members to primary members, such as purlins, girts, and other framing members carrying only nominal stresses and for temporary bracing to facilitate erection.
 - 4. High-strength bolting - Conform to [AISC S329](#). Unless otherwise noted, use slip-critical connections as modified by bonding and grounding requirements. Use load-indicating washers and hardened steel washers with high-strength bolts, in accordance with [ASTM F959](#).
 - 5. Cut, drill or punch at right angles to surface of metal; do not make or enlarge holes by burning. Ensure that holes are clean-cut, without torn or ragged edges. Remove outside burrs resulting from drilling or reaming operations with a tool making a 0.063 in. bevel.
 - 6. Insert bolts into holes without damaging thread. Protect bolt heads from damage during driving. Ensure that bolt heads and nuts rest squarely against metal. Where bolts will be used on beveled surfaces having slopes greater than 1:20 with a plane normal to bolt axis, provide beveled washers to give full bearing to head or nut.
 - 7. [ASTM A307](#) low carbon steel threaded fasteners - Ensure that length extends through, but not more than 1/8 in. beyond, nuts. Draw bolt heads and nuts tight against work with a wrench not less than 15 in. long. Tap bolt heads with a hammer while nut is being tightened. Nuts - Locked after tightening. Where self-locking nuts are not furnished, provide upset bolt threads.
- h. Shear Connectors
 - 1. Shear connectors - Shop weld to beams or girders in composite construction; space as indicated.
 - 2. Headed stud-type shear connectors - Automatically end welded in accordance with headed stud manufacturer's printed recommendations, and by personnel familiar with installation

equipment and procedures.

i. Column Bases and Bearing Plates

1. Provide column bases under columns; milled and attached to columns as indicated.
2. Provide bearing plates under beams, girders, and trusses resting on footings, piers, or walls.

j. Trusses

1. Do not splice truss chords without prior written approval of COTR. If splices are approved to avoid problems due to handling and shipping, splice chords at panel points at approximately third points. Ensure that, whenever possible, center of gravity lines of truss members intersect at panel points; when center of gravity lines do not intersect at panel points, make provisions for stresses due to eccentricity.

1.6 BONDING AND GROUNDING

Perform bonding of joints and connections where indicated. Faying surfaces - Clean and abrasive-blasted to near-white metal. Coat faying surfaces to avoid crevice corrosion.

1.7 DRAINAGE HOLES

Drill $\frac{1}{2}$ in. diameter drainage holes to eliminate water traps; locate holes as indicated on detail drawings. Ensure that hole size and location do not adversely affect structural integrity.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

- a. Structural Steel Shapes Except W-shapes, Bars and Rod shall conform to **ASTM A36**.
- b. W-shapes shall be **ASTM A-992** Grade 50. Plate material for frame connections shall be **ASTM A572** Grade 50.
- c. Stainless Steel - **ASTM A242M**.
- d. Structural Tubing - **ASTM A500**, Grade B.
- e. Steel Pipe - **ASTM A53**, Grade B, Type E or S.

2.2 FASTENERS

- a. High-strength Bolts, Nuts and Washers - **ASTM A325**. Galvanizing - **ASTM A153** and **ASTM B695**.
- b. Other Bolts and Nuts - **ASTM A307**, Grade A. Round washers - **ASME B18.22.M**, Type B, plain. Galvanizing - **ASTM A153** and **ASTM B695**.
- c. Anchor Bolts, Nuts and Washers - **ASTM A307**. Galvanizing - **ASTM A153**.
- d. Load-indicating Washers - **ASTM F959**.

2.3 WELDING MATERIALS

AWS D1.1.

- a. Filler Metal - AWS D1.1, 70 Series.
- b. Electrodes - AWS A5.5, E70XX.

2.4 PROTECTIVE COATING

- a. Steelwork - Shop primed, except surfaces of steel to be encased in concrete, surfaces to be welded, contact surfaces to be high-strength bolt connected, galvanized surfaces, and surfaces of crane rails. Surface preparation - SSPC SP-3.
- b. Primer and Other Paint - As specified in Section 09890, Protective Coating of Carbon Steel.

2.5 GROUT

- a. Shrinkage-resistant Grout - CRD-C621, premixed and packaged ferrous aggregate grouting compound.
- b. Portland Cement Grout - ASTM C150, Type I or Type II. Aggregate for cement grout - Clean, sharp, uniformly graded natural abrasive; ASTM C404, Size 2. Mixing water - Potable.
- c. Anchoring Adhesive - ASTM C658. Acceptable products:
 1. HIT RE-500 SD adhesive anchor HILTI Inc., 5400 South 122nd East Avenue, Tulsa, OK 74146, (800)879-8000
 2. SET-XP epoxy adhesive anchors, Simpson Strong-TIE Company, Inc., 5956 West Las Positas Boulevard, Pleasanton, CA 94588, (800)999-5099.
 3. ITW RED HEAD EPCON G5 adhesive anchor, ITW RED HEAD, 2171 Executive Drive, Suite 100, Addison, IL 60101, (800)899-7890.

PART 3 EXECUTION

3.1 GENERAL

- a. Perform erection of structural steel in accordance with AISC M016 and AISC S303, with modifications and additional requirements as specified.
- b. Equipment - Suitable and safe for workmen. Maintain falsework in a safe and stable condition until steel structure is fully self-supporting.

3.2 ANCHOR BOLTS

- a. Perform bolting and other connections between structural steel and foundations or existing structural steel as part of the work.
- b. Accurately locate bolts and anchors, and build into connecting work; preset by using templates or other methods to locate bolts and other connections.

3.3 SETTING COLUMN BASES AND BEARING PLATES

- a. Ensure that loose and attached column base plates and bearing plates for beams and similar structural members are aligned with wedges or shims and are bedded with damp-pack bedding.
- b. Concrete Bearing Surfaces - Clean free of laitance, dirt, oil, grease, and other foreign material. Roughen concrete surfaces, but not enough to interfere with placing bedding. Clean bottom surface of base or bearing plates free of dirt, oil, grease, and other foreign materials.
- c. Make space between top of bearing surface and bottom of base or bearing plate approximately 4 percent of width of base or bearing plate, but not less than $\frac{1}{2}$ in. for base or bearing plates that are less than 12 in. wide. Support and align base or bearing plates on steel wedges or shims. Provide forms to retain grout until it sets.

3.4 SHEAR CONNECTORS

- a. Welding - Establish correct arc current and time cycle. Hold welding gun steadily during cycle until weld metal has solidified.
- b. Trial Welds - Establish welding procedure by making trial welds on test plates and adjust weld current, time cycle, lift, and other variables until satisfactory welds are obtained.
 1. Test plate - Approximately same thickness as steel flange to which studs will be welded.
- c. Welded Studs - Provide full 360 degree welds.

3.5 FIELD ASSEMBLY

- a. Assemble structural steel frames to lines and elevations indicated. Align and adjust members forming parts of a completed frame or structure after assembly and before fastening. Fasten splices of compression members after bringing abutting surfaces into complete contact. Clean bearing surfaces and surfaces that will be in permanent contact before members are assembled.
- b. Splices are permitted only where indicated. Remove erection bolts used in welded construction and fill holes with plug welds.
- c. Bracing, adequacy of temporary connections and supports, alignment, and removal of paint on surfaces adjacent to field welds - as specified in [AISC S303](#).
- d. Install high-strength bolted connections with load-indicating washers.
- e. Welding for redrilling is not permitted. Do not enlarge holes more than 0.063 in. greater than specified hole diameter without approval of COTR.

3.6 GAS CUTTING

Do not use gas-cutting torch in field for correcting fabrication errors on any major member in structural framing. Gas-cutting torch will be permitted on minor members not under stress only with prior approval from

COTR.

3.7 TOUCHUP PAINTING

After erection of structural steel, touch-up bolt heads and nuts, field welds, other areas left unpainted, and abrasions in shop coat as specified in Section 09890, Protective Coating of Carbon Steel. Perform touch-up and repair as soon as possible after damage or installation has occurred.

3.8 INSPECTIONS AND ACCEPTANCE PROVISIONS

- a. All inspections, including special inspections and continuous inspections shall be done by an independent, qualified testing agency and qualified inspectors at the expense of the Contractor. Government shall be notified 24 hours in advance to witness all the tests. All reports and test results documentation shall be submitted to the Government.
- b. Inspections will include proper preparation, size, gaging location, and acceptability of welds; identification marking; operation and current characteristics of welding sets in use; and installation of high-strength bolts.
- c. Inspection of Welding - Performed in accordance with AWS D1.1, Section 6, Inspection. Nondestructive testing performed as follows:
 1. Visual inspection - All welds.
 2. Magnetic particle testing - ASTM E709. All partial penetration welds.
 3. Ultrasonic testing - ASTM E164. All full penetration welds.
- d. Inspection of High-strength Bolted Connections - Performed in accordance with AISC S329.
 1. For bolts installed using direct tension indicator devices, a representative sample of minimum 3 devices for each diameter and grade of fastener will be tested with 3 typical bolts in a calibration device capable of indicating bolt tension.
 2. Average gap between face of direct tension indicator and underside of bolt head: 0.020 in.

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DIVISION 05 - METALS

SECTION 05500

MISCELLANEOUS STEEL

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SECTION 05500

MISCELLANEOUS STEEL

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for miscellaneous steel items.

1.2 REFERENCES

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC S303 Code of Standard Practice for Steel Buildings and Bridges

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A36M Carbon Structural Steel

ASTM A47M Ferritic Malleable Iron Castings

ASTM A48M Gray Iron Castings

ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coded, Welded and Seamless

ASTM A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A283M Low and Intermediate Tensile Strength Carbon Steel Plates

ASTM A366M Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality

ASTM A500 Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A525M General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quantity

ASTM A526M Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality

ASTM A569M Steel, Carbon (0.15 Maximum, Percent) Hot-Rolled Sheet and Strip, Commercial Quality

ASTM A575M	Steel Bars, Carbon, Merchant Quality, M-Grades
ASTM A786M	Rolled Steel Floor Plates
AMERICAN WELDING SOCIETY, INC. (AWS)	
AWS A2.4	Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS A5.1	Carbon Steel Electrodes for Shielded Metal Arc Welding
AWS D1.1	Structural Welding Code - Steel
CODE OF FEDERAL REGULATIONS (CFR)	
29 CFR 1910	Occupational Safety and Health Standards
FEDERAL SPECIFICATIONS (FS)	
FS FF-B-561	Bolts (Screw), Lag
FS FF-B-575	Bolts, Hexagon and Square
FS FF-B-588	Bolt, Toggle, and Expansion Sleeve, Screw
FS FF-N-836	Nut, Square, Hexagon. Cap, Slotted, Castle Knurled. Welding and Single Ball Seat
FS FF-S-92	Screw, Machine: Slotted, Cross-Recessed or Hexagon Head
FS FF-S-111	Screw, Wood
FS FF-S-325	Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FS FF-W-84	Washers, Lock (Spring)
FS FF-W-92	Washer, Flat (Plain)
FS RR-C-271	Chains and Attachments, Welded and Seamless
FS RR-G-661	Grating, Metal, Bar Type (Floor, Except for Naval Vessels)
FS RR-T-650	Treads, Metallic and Nonmetallic, Skid Resistant

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

[SD-02, Manufacturer's Catalog Data](#)

[Manufacturer's Catalog Data](#) for catalog items.

SD-04, Shop Drawings

Take field measurements before preparing drawings and starting fabrication. Include location of each miscellaneous metal item in building; dimensions, size, and mass or thickness as applicable of members; types and locations of shop and field connections; construction and erection details; welds in accordance with AWS A2.4; and locations and details of anchorage devices that are to be embedded in cast-in-place concrete and masonry construction.

SD-20, Welding Procedures and Qualifications

1.4 QUALIFICATIONS FOR WELDING WORK

- a. Welding Procedures - In accordance with AWS D1.1.
- b. Welders - Certified to have been qualified by tests in accordance with AWS D1.1, or by an equivalent approved qualification test.

1.5 REQUIREMENTS

- a. Furnish and install supplementary parts necessary to complete each item. Furnish promptly to the appropriate trades anchors, sockets, or fastenings required for securing metal work to other structures. Details and specifications of items for which standard products are available are representative guides of minimum requirements for such items. Standard products, generally meeting such requirements, will be accepted subject to approval. Provide continuous welding along entire area of contact except where tack welding is indicated. Tack welding is not permitted on exposed surfaces.
- b. Use templates and patterns for proper fitting of hardware and other accessories wherever feasible.
- c. Make substitutions of materials or modification of details, or both, only when warranted and approved.
- d. Drill $\frac{1}{8}$ in. diameter drainage holes to eliminate water traps. Indicate locations of holes on detail drawings for approval of COTR. Ensure that hole sizes and locations do not affect structural integrity.

1.6 FABRICATION

- a. Fabricate miscellaneous structural steel work in accordance with AISC S303.
- b. Mill joints to a close fit. Corner joints - Coped or mitered, well-formed, and in true alignment. Form and fabricate joints exposed to weather so as to exclude water.
- c. Castings - Sound and free from warp or defects that impair strength and appearance. Ensure that exposed surfaces have a smooth finish and sharp, well-defined lines and arises. Mill joints to a close fit.
- d. Provide holes as indicated for securing items to metal work.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

- a. Plates, Shapes, and Bars - [ASTM A36M](#).
- b. Bent or Cold Formed Plates - [ASTM A283M](#), Grade C.
- c. Square or Rectangular Tubing - [ASTM A500](#), Grade B; hot formed, welded or seamless.
- d. Steel Pipe - [ASTM A53](#), Grade B, Type E or S.
- e. Bars and Bar Sizes - [ASTM A575](#), Grade M1020.
- f. Hot-rolled Sheets and Strip - [ASTM A569M](#), uncoated.
- g. Cold-rolled Sheets - [ASTM A366M](#), uncoated.
- h. Galvanized Sheets - [ASTM A526](#). Galvanizing - [ASTM A525M](#), Z275.

2.2 RAISED PATTERN STEEL FLOOR PLATES

Structural-quality [ASTM A36](#) steel with a raised figure pattern at regular intervals on surface flatback style conforming to [ASTM A786](#), Pattern 3, 4 or 5.

2.3 STEEL BAR GRATING

Provide [FS RR-G-661](#), Type I or II; [ASTM A36](#) steel. Provide end-banding bars, anchors, and other components as required to suit conditions indicated. Steel grating galvanized after fabrication.

2.4 FASTENERS

- a. Bolts - Regular hexagon head, carbon steel, coarse thread, [FS FF-B-575](#), Type II, Gr 1.
- b. Nuts - Regular hexagon head, carbon steel, coarse thread, [FS FF-N-836](#), Type II, Style 4, Gr A.
- c. Machine Screws - Phillips flat head, carbon steel, [FS FF-S-92](#), Type III, Style 2C or 3C.
- d. Plain Washers - Round, general, carbon steel, [FS FF-W-92](#), Type A, Grade I, Class A.
- e. Lock Washers - Helical spring, carbon steel, [FS FF-W-84](#), Class A.
- r. Concrete Wedge Anchors - Galvanized, Redhead, Hilt, or approved equal, of nominal bolt diameter and actual embedment specified.
- g. Electrodes for Manual Shielded Metal Arc Welding - [AWS D1.1](#); mild steel electrodes conforming to [AWS A5.1](#), E60 series.

2.5 FINISHES

- a. Miscellaneous Metal Work, except metal surfaces embedded in concrete surfaces and edges to be field welded, and galvanized surfaces - Prime

as specified in Section 09890, Protective Coating of Carbon Steel, unless otherwise indicated.

- b. Miscellaneous Metal Work Exposed to View - Provide top-coats to match existing SVS structure.

2.6 FABRICATED PRODUCTS

a. Cast Abrasive Thresholds

1. Thresholds - Gray iron castings with fluted tread and abrasive grit embedded uniformly into walking surface at time of casting. Gray iron castings - ASTM A48M Class 20. Abrasive: #20 grain aluminum oxide or silicon carbide, or a combination of both. Screws for securing cast-iron thresholds - Zinc- or cadmium-coated.
2. Thresholds to concrete floor slab - Secured with lead expansion shields and 0.24 in. flathead machine screws.

b. Floor Gratings and Frames

1. Gratings - Carbon steel with parallel bearing bars, right angle or diagonal cross members, conforming to FS RR-G-661, Type I or Type II. Grating panel and bearing bar sizes - As indicated. Provide each panel with end-banding bars, four saddle clip anchors designed to fit over two bearing bars, and four stud bolts with plain washers and nuts.
2. Frames - Structural steel angles, all-welded construction, fabricated so that tops of frames and floor grating are flush with finished floor. Provide anchors welded to frame, spaced at 6 in. maximum from ends of frame sections, 6 in. maximum from corners, and 2 ft maximum on center between end and corner anchors. Anchors - Structural steel bars, 5/8 in. wide x 3/8 in. thick unless otherwise indicated, length as required for a minimum embedment of 6 in. in concrete.
3. Grating panels - Removable. Stud bolts to receive saddle clip anchors - Field welded to frame. Notching of bearing bars at supports is not permitted. Provide openings in grating as indicated.
4. Gratings and frames, fasteners and clips - Galvanized.

c. Floor Plate Covers and Frames

1. Covers - Carbon steel plates with a raised figure pattern at regular intervals on surface, conforming to ASTM A786, Pattern No. 3, 4, or 5.
2. Cover sections - Width and thickness as indicated. Length - Limited by maximum mass of 99 lbs. Provide each floor plate cover section with holes to receive flathead machine screws and two flush lifting rings (one at each end of section). Ensure that covers are free of sharp edges and burrs.
3. Frames - Structural steel angles and steel bar stops, all-welded construction, fabricated so that tops of frames and floor plate covers are flush with finished floor. Provide anchors welded to

frame, spaced at 6 in. maximum from ends of frame sections and corners, and 2 ft maximum on center. Anchors - Structural steel bars 5/8 in. wide x 3/8 in. thick unless otherwise indicated, length as required for a minimum embedment of 6 in. in concrete. Drill and tap frames to receive machine screws.

4. Plate covers - Removable and secured to frame with 3/8 in. machine screws at 3 in. maximum from each cover end and at 12 in. maximum on center. Machine screws - Zinc- or cadmium-coated. Provide openings in plate covers as indicated.
5. Floor plates and frames - Galvanized.

d. Ladders

1. Ladders - Fixed-rail type, located and detailed as indicated. Rungs 5/8 in. solid-section structural steel rods at 12 in. on center. Side rails - Structural steel flat bars 2.5 in. x 0.5 in. with rounded edges unless otherwise indicated, 16 in. on center, and conforming to 29 CFR 1910.27. Rungs - Fitted into punched holes in side rails, welded, and ground smooth. Splices and connections - Provide a smooth transition with original members, without projections that are sharp or more extensive than required for joint strength. Provide ladders with structural steel brackets, drilled to receive anchor bolts, and welded to side rails. Bracket spacing: 10 ft maximum.
2. Ladders, brackets and fasteners - Galvanized.

e. Ladder Safety Cages

1. Cages - Basket guard hoop type, located and detailed as indicated; fabricated from structural steel flat bars and assembled by bolting or welding. Provide 4 in. wide x 0.30 in. thick top and bottom hoops, and intermediate hoops at 20 ft maximum on center between top and bottom hoops. Provide 2 in. wide x 0.3 in. thick hoops between 4 in. wide hoops at 4 ft maximum on center. Provide vertical bars 2 in. wide x 0.3 in. thick at 9 in. or 40 diameters maximum. Fasten hoops to steel ladder side rails with 1/2 in. steel bolts, or shop weld.
2. Ladder safety cages and fasteners - Galvanized.

f. Miscellaneous Steel Framing and Supports - Provide miscellaneous steel framing and supports that do not form a part of structural steel framework to complete the Work. Exterior miscellaneous steel framing and supports - Fabricated of structural steel plates, shapes, bars, and tubing; of sizes and arrangement indicated; and galvanized.

g. Safety Chains

1. Provide chains for each guarded opening were indicated, complete with snap fasteners on each end and eye bolts for attachment of chains.
2. Chains - Galvanized, welded type, proof coil steel, 0.20 in. diameter nominal size, with 33 links per meter minimum, proof loading 1012 lbs minimum, conforming to FS RR-C-271, Type I, Grade C, Class 4.

3. Snap fasteners - Boat type with strength equivalent to chain proof loading. Eye bolts for attachment of chains: $3/8$ in. diameter bolt with $5/8$ in. diameter eye; strength equal to chain proof loading. Safety fasteners and eye bolts - Galvanized.
 4. Provide two chains 6 in. longer than anchorage spacing for each guarded opening. Mount top chain 3.5 ft minimum above floor, and mount second chain 2 ft above floor.
- h. Steel Pipe Railings
1. Provide steel pipe railings, including guard at open-sided areas, consisting of top rail, intermediate rail and posts, and handrails at walls, as indicated.
 2. Minimum sizes: 1.5 in. nominal diameter, and standard weight pipe conforming to ASTM A53, Type E or Type S, Grade B; or 1.5 in. nominal diameter, 2.72 lbs/ft, round structural steel tubing.
 3. Join posts, rails, and corners by one of following methods:
 - a) Use flush-type steel railing fittings, welded and ground smooth, and secure railing splice locks with $2/5$ in diameter hexagonal recessed-head setscrews.
 - b) Make mitered and welded joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Railing splices - Butted and reinforced by a tight-fitting interior sleeve 6 in. long minimum.
 4. Railings may be bent at corners instead of joining, provided bends are made in suitable jigs and cylindrical cross section of pipe is maintained throughout entire bend.
 5. Provide kickplates between railing posts where indicated, comprising steel flat bars minimum 6 in. high x 0.24 in. thick. Secure kickplates as indicated.
 6. Railings, including pipe, fittings, brackets, fasteners, and other ferrous metal components - Galvanized.
- i. Steel Stairs
1. Steel stairs - Constructed to conform to sizes and arrangements indicated. Provide steel framing, hangers, columns, struts, clips, brackets, bearing plates, and other components as required to support stairs and platforms.
 2. Stringers - Structural steel channels or structural steel plates, or a combination thereof, as indicated. Close exposed ends of stringers.
 3. Construct platform of structural steel channel headers and miscellaneous framing members as indicated. Bolt headers to stringers and newels; bolt framing members to stringers and headers.

PART 3 EXECUTION

3.1 GENERAL

Install Work in accordance with approved shop drawings and descriptive data for each miscellaneous steel item, as specified, and securely fasten plumb and true to lines and levels.

3.2 FASTENING TO CONSTRUCTION-IN-PLACE

Provide anchorage devices and fasteners where necessary for fastening miscellaneous steel items to construction-in-place. Fastening includes threaded fasteners for concrete inserts embedded in cast-in-place concrete; threaded fasteners for concrete-in-place; and threaded fasteners for structural steel. Fastening to wood plugs in masonry or concrete-in-place is not permitted.

3.3 CUTTING AND FITTING

Perform cutting, drilling, and fitting for installation of miscellaneous steel Work. When required, fit Work in place before fastening.

3.4 FIELD WELDING

- a. Procedures for Welding - As approved. For appearance and quality of welds made, and methods used in correcting welding Work, conform to **AWS D1.1**, Workmanship and Technique.
- b. Provide continuous welding along entire area of contact. Exposed welds - Ground smooth.

3.5 THREADED CONNECTIONS

Where exposed to view, make bolt and screw heads flat and countersunk, unless otherwise specified. Threaded connections - Make up tightly so that threads are concealed by fitting.

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SECTION 07600

FLASHING AND SHEETMETAL

08/06

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SECTION 07600

FLASHING AND SHEETMETAL
08/06

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for flashing and other sheetmetal work.

1.2 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A526M	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality
ASTM B32	Solder Metal
ASTM B209M	Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B224	Classification of Coppers
ASTM B370	Copper Sheet and Strip for Building Construction
ASTM C920	Elastomeric Joint Sealants
ASTM D2822	Asphalt Roof Cement

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION
(SMACNA)

SMACNA-93	Architectural Sheet Metal Manual
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1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-04, Shop Drawings

Shop Drawings, indicating location, dimensions, and configuration of sheetmetal; construction details; type of seams; joints; fastening method; material description and thickness.

PART 2 PRODUCTS

2.1 SHEETMETAL MATERIALS

- a. Materials - Minimum SMACNA-93 thickness and weights.
- b. Lead Flashing and Lead Washers: 4 lbs/ft², 0.06 inch thick.
- c. Galvanized Steel Sheet - ASTM A526M, regular coating, designation Z90.

- d. Stainless Steel: 26 ga, A304, corrosion-resistant steel.

2.2 SHEET METAL THICKNESSES

Following table specifies minimum acceptable sheet thickness for corresponding applications:

APPLICATION	ALUMINUM in.	STAINLESS STEEL inch (gage)	GALVANIZED STEEL inch (gage)	LEAD lbs/ft2
Bellows or flanges, U-type	--	0.02 (28)	0.024 (24)	--
Flashings				
Base	0.03	0.02 (28)	0.035 (22)	3.0
Cap, supports	0.03	0.02 (28)	0.024 (24)	2.5

Note: "--" indicates "May not be used."

2.3 FASTENERS AND SOLDER

- a. Fasteners - Of same metal as material joined, or of a metal compatible with material joined.
- b. Solder and Flux - [ASTM B32](#). Solder - SN50.

2.4 CEMENTS AND SEALING COMPOUNDS

- a. Bituminous Plastic Cement - Asphaltic-base material conforming to [ASTM D4586](#), compatible with roofing asphalts and asphalt primer.
- b. Sealing Compound - Gun grade, one-component, nonsag, elastomeric, conforming to [ASTM C920](#). Base material - Polyurethane, resistant to 50 percent joint movement.
- c. Aluminum-seam Sealant - As recommended by aluminum manufacturer.

2.5 ENDLAP SEALANT TAPE

Endlap sealant tape (gasket material) shall be a 1 inch wide isobutylene-isoprene copolymer tape. Sealant tape shall release cleanly in the hot and cold weather from the backing paper at temperatures ranging from -10°F to 140°F. Sealant tape shall have the following minimum properties.

- a. Sealant tape shall not sag more than 0.05 in. after hanging in the vertical position for 48 hours.
- b. Penetration limits (degrees of hardness) determined in accordance with [ASTM D217](#), 300 gram cone:

At 0°F ±2°F	45 ± minimum
At 77°F ±2°F	100 ± minimum
At 120°F ±2°F	135 ± minimum
- c. Composition shall be isobutylene-isoprene rubber and fine inert silica fillers. Asbestos fillers are not acceptable.

- d. Thickness shall be 0.125 in.
- e. Flexibility per ASTM C765 - no cracking at -60°F.
- f. Webbing and elongation - at 0°F, minimum 500%; at 77°F, minimum 1000%.
- g. Cohesive Tensile Strength per ASTM D897 metal - 25 psi minimum.

PART 3 EXECUTION

3.1 GENERAL

- a. Sheetmetal Work - Conform to drawing details and to applicable plate number and design and installation recommendations of SMACNA-93. Ensure that finished sheetmetal installation is free from water leakage.
- b. Ensure that surfaces to receive sheetmetal work are clean, smooth, dry, and free from defects and projections that might affect Work. Make surfaces plumb and true to a maximum tolerance of 1:1000, with no dips, waves, or uneven surfaces exceeding 1:1000 in any direction. Make lines, arises, and angles sharp and uniform. Fold back exposed edges of sheetmetal to form a ½ in. wide hem on concealed side.
- c. Fastening Methods
 - 1. Use concealed fasteners. Nail only one edge to permit freedom of expansion perpendicular to line of nailing. Space nails at maximum 3 in. on center. Ensure that nails penetrate backing by 1 in. minimum.
 - 2. Use cleats for securing edges of sheetmetal members over 12 in. wide and at other designated locations. Fasten cleats with two nails, and fold end over nails. Lock other end of cleat into seam or folded edge of member being fastened. Space cleats at 12 in. maximum.
- d. Seams
 - 1. Seams and lock joint construction - Conform to SMACNA-93, Plate 131.
 - 2. Make seams straight and uniform in height, width, and finish as follows:
 - a) Flat-lock seams: 0.75 in. wide minimum
 - b) Lap seams, when soldered - Finish 1 in. wide minimum
 - c) Lap seams, not soldered - Overlap 3 in. minimum
 - d) Loose-lock expansion seams: 3 in. wide minimum providing for minimum 1 in. movement within joint. Completely fill joint with sealant with 0.1 in. bed thickness minimum
 - e) Flat seams - Make in direction of flow. Seams that are not soldered - Completely fill with approved sealant.
- f. Dissimilar Metals - Isolate from each other by painting with bituminous paint.

3.2 FLASHING

- a. Base Flashing

1. Install metal base flashing where roof abuts vertical surfaces, in valleys, at ridges, and where roof slope changes. Configuration - Conform to [SMACNA-93](#).
 2. Extend flashing 8 in. minimum up vertical surfaces.
- b. Cap and Counter Flashing
1. Install metal cap or counter flashing where horizontal roof surfaces abut vertical wall surfaces, at copings, at joints between existing and new construction, at penetrations of roof surfaces, and at equipment supports. Configuration - Conform to [SMACNA-93](#).
 2. Form flashing in 10 ft lengths, except where shorter pieces are required; lap end joints 3 in. minimum; do not solder joints.
- c. Edge Trim Strips - Provide a formed drip edge.
- d. Flashing at Roof Penetrations and Equipment Supports - Install metal flashing conforming to [SMACNA-93](#) where piping, conduit, or equipment supports penetrate roof surfaces. Single-pipe vents - Flashed with lead flashing or a two-piece formed-metal housing of specified sheetmetal, installed in accordance with [SMACNA-93](#), Plate 59, Figures B and C.
- 3.3 CLEANING

Clean exposed sheetmetal work at completion of installation. Remove grease and oil films; handling, scratch, and solder marks; and steel wool, filing, and drilling debris. Scrub sheetmetal work clean.

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SECTION 07900

SEALANTS AND CALKINGS

08/06

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SECTION 07900

SEALANTS AND CALKINGS
08/06

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for sealants and calkings.

1.2 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C726	Mineral Fiber Roof Insulation Board
ASTM D1056	Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D1622	Apparent Density of Rigid Cellular Plastics
ASTM D1623	Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics

FEDERAL SPECIFICATIONS (FS)

FS QQ-A-1876	Aluminum Foil
FS TT-C-598	Calking Compound, Oil and Resin Base Type (For Masonry and Other Structures)
FS TT-P-38	Paint, Aluminum (Ready-Mixed)
FS TT-S-230	Sealing Compound: Elastomeric Type, Single Component (for Calking, Sealing, and Glazing in Buildings and Other Structures)
FF UU-P-270	Paper Wrapping, Waxed (Dry)

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

[SD-02, Manufacturer's Catalog Data](#)

[Manufacturer's Catalog Data](#), for each type of sealing compound to be used in Work. Include backup material, bond-preventive material, primer for each kind of surface, solvents, cleaning agents, and wetting agents as recommended by manufacturer.

[SD-06, Manufacturer's Instructions](#)

[Manufacturer's Instructions](#), for each type of sealing compound to be used in Work. Include surface preparation, recommended joint dimensions, and sealing-compound application.

1.4 DELIVERY, HANDLING, AND STORAGE

Deliver calking and sealing materials to Worksite in sealed containers bearing labels clearly identifying name of each compound, formula or specification number, color, date of manufacture, shelf life, curing time at 77°F, manufacturer's directions, and name of manufacturer. Store materials in original, unbroken package or container in a weathertight and dry place, and protect from freezing until required for use in Work.

PART 2 PRODUCTS

2.1 COLOR OF SEALANT

Match color of adjacent materials as closely as possible; subject to approval before installation.

2.2 BACKUP MATERIAL

- a. Polyethylene Backup Material - Expanded closed-cell polyethylene rod. Use polyethylene with following property values:
 1. Density - ASTM D1622, 2 lbs/ft³ to 5 lbs/ft³.
 2. Compression deflection - ASTM D1056, minimum 25 percent at 20 psi.
 3. Tensile strength - ASTM D1623, minimum 20 psi.
 4. Water absorption - ASTM D1056; maximum 5 percent by weight.
- b. Synthetic Rubber Backup Material - Expanded closed-cell elastomeric preformed rods or tubes. Provide rods for joints ½ in. and under in width; rod diameter minimum 30 percent greater than joint width. Provide tubes for joints over 13 mm in width; tube outside diameter minimum 50 percent greater than joint width, and tube wall thickness minimum 0.2 in.

2.3 PRIMER-TO-SEALANT COMPOUNDS

- a. Paint Primer for Calking Compound - Aluminum paint, FS TT-P-38.
- b. Primer for Elastomeric Sealing Compound - As recommended by sealing-compound manufacturer for use on kind of substrate material encountered in Work. Test primer for staining, durability, and dirt pickup on the surfaces to be sealed.

2.4 ONE-COMPONENT SEALANTS

- a. Calking Compound - Oil- and resin-base gun type, FS TT-C-598, Type I.
- b. Polysulfide-base Elastomeric Sealing Compound - Nonsag type, resistant to 25 percent total movement, FS TT-S-230, Type II, Class B, except that base material is polysulfide.
- c. Urethane-base Elastomeric Sealing Compound - Nonsag, resistant to 50 percent total movement, FS TT-S-230, Type II, Class A, except that base material is urethane.
- d. Silicone-rubber Base Elastomeric Sealing Compound - Nonacid base,

nonsag, resistant to 50 percent total movement, FS TT-S-230, Type II, Class A, except that base material is nonacid silicone rubber.

2.5 SOLVENTS AND CLEANING AGENTS

As recommended by the sealing compound manufacturer and as listed in approved catalog data.

PART 3 EXECUTION

3.1 GENERAL

- a. Install calking and sealing materials in accordance with approved catalog data and as specified.
- b. Use components of each formula only with that formula; do not intermix components of different formulas. Do not use thinners or other additives to modify formula.
- c. Do not install calking and sealing compounds when ambient temperature is below 39°F or above 100°F. Do not apply exterior calking and sealing compounds in damp or rainy weather; ensure that surfaces of joints to be sealed have dried from effects of such weather.
- d. Do not allow condensation to form on joint surfaces that will receive calking or sealing compounds. Provide ventilation as required to prevent formation of condensation on such surfaces.

3.2 SURFACE PREPARATION

- a. Clean surfaces of joints to be sealed free of loose particles, oil, grease, water, frost, surface dust, coatings, and other foreign matter, by brushing, sandblasting, acid washing or solvent methods, as recommended by sealant manufacturer. Remove laitance from cleaning before applying sealant.
- b. Joints Receiving Calking Compound - Minimum depth 0.4 in., maximum depth ½ inch. Give porous surfaces such as masonry, concrete, stone, or wood on sides of joint cavity a uniform coating of paint primer for calking compound.
- c. Joints Receiving Elastomeric Sealing Compound - Minimum depth 0.24 in. Depth of elastomeric sealing compound - Equal to joint width in joints up to 10 mm wide; 0.39 in. in joints 0.43 in. to 1 in. wide.
- d. Joints with a Depth less than Specified Minimum - Rake out to obtain proper depth. Joints with a depth exceeding specified maximum - Fill with rope yarn or polyethylene backup material to obtain proper depth; pack rope yarn backup material tightly; roll polyethylene backup material into joint cavity so as to avoid lengthwise stretching, twisting, and braiding.
- e. Mask adjacent finished surfaces, as required, to protect them from smears.

3.3 APPLICATION

- a. Gun-apply calking compound with a nozzle of proper size to fit joint width, and solidly force compound into joint cavity. Ensure that

finished exposed surfaces of calking compound are sufficiently convex to result in a flush joint when calking compound has dried, and are uniformly smooth and free from wrinkles.

- b. Gun-apply elastomeric sealing compound with a nozzle of proper size to fit joint width, and force compound into joint cavity with sufficient pressure to expel air and to solidly fill joint cavity. Firmly tool surface of sealing compound in place using wetting agent recommended by manufacturer of sealing compound. Ensure that finished exposed surfaces of sealing compound are slightly concave, uniformly smooth, and free from cracking and air bubbles.
- c. Ensure that metal and other surfaces to receive joint-sealant tape are clean and dry. Place tape on one surface with removable backing exposed. Remove backing immediately before placing next plate. After plates are placed and lapped and holes in plates are matched, cold-punch holes for bolts through tape, or pierce tape through bolt holes with an X-shaped cut without deforming tape adjacent to bolt holes. Do not stretch tape; lap tape 1 in. minimum at splices. At corner laps of plates and at other laps requiring additional sealant material to make waterproof joints, place as many thicknesses of tape as required to fill voids. Store tape at ambient temperatures of less than 100°F, and handle and store so as to not deform tape from its original shape.

3.4 INSPECTION AND ACCEPTANCE PROVISIONS

- a. Clean surfaces adjoining sealed joints free of compound smears or other soiling resulting from application of specified compounds.
- b. Calking and sealing work will be rejected if color does not match that of approved sample, if finished surface does not conform to requirements, or if compound fails to adhere to joint surfaces at sides of joint.
- c. Remove defective work and replace with new acceptable work.

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DIVISION 09 - FINISHES

SECTION 09890

PROTECTIVE COATINGS OF CARBON STEEL

08/06

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- 1.4 DELIVERY, HANDLING, AND STORAGE
- 1.5 PROTECTION OF EQUIPMENT AND ADJACENT SURFACES
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- 3.4 CALKING
- 3.5 INSPECTION

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SECTION 09890

PROTECTIVE COATINGS OF CARBON STEEL
08/06

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for protective coating of carbon steel.

1.2 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C920 Elastomeric Joint Sealants

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP 1 Solvent Cleaning

SSPC SP 3 Power Tool Cleaning

SSPC SP 10 Near-White Blast Cleaning

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

SD-02, Manufacturer's Catalog Data

Manufacturer's Catalog Data for materials proposed for use.

SD-02, Manufacturer's Standard Color Charts

Manufacturer's Standard Color Charts for finish coats, when applicable.

SD-06, Manufacturer's Instructions

Manufacturer's Instructions for materials proposed for use.

1.4 DELIVERY, HANDLING, AND STORAGE

- a. Deliver materials in their original, unopened containers bearing manufacturer's name, shelf-life, product identification, and batch number.
- b. Store coatings, thinners, and cleaners in tightly closed containers in a covered, well-ventilated area where they will be protected from exposure to extreme cold or heat, sparks, flame, direct sunlight, or rainfall. Follow manufacturer's instructions for storage limitations.

1.5 PROTECTION OF EQUIPMENT AND ADJACENT SURFACES

Protect equipment and adjacent surfaces from damage such as abrasive intrusion, overblast, and overspray.

1.6 PERSONNEL SAFETY

Ensure safety of personnel engaged in these operations and of personnel who may be affected by such operations. Comply with OSHA regulations and manufacturer's recommendations. Some materials to be handled are combustible or toxic, or both. Using material safety information supplied by manufacturer, provide equipment as required for safe application, and instruct users on hazards and proper handling procedures to prevent health hazards or possible explosion.

PART 2 PRODUCTS

2.1 ABRASIVE BLASTING MATERIAL

Unused sharp silica sand, medium mesh, (approximately 20/30), or other approved low-dusting material.

2.2 SEALANT COMPOUND

Self-curing, single component, polysulfide-rubber type conforming to **ASTM C920**; gray in color, capable of being applied into joint with a calking gun.

2.3 PROTECTIVE COATINGS

a. Coating System

1. Primer - Inorganic zinc only, selected from following listing.

<u>INORGANIC ZINC</u>	<u>MANUFACTURER</u>
Carbo Zinc 11	Carboline Company, 350 Hanley Industrial Ct. St. Louis, MO 63144, (314) 644-1000
Catha-Coat 304	Devoe & Reynolds Co., P.O. Box 7600, Louisville, KY 40207, (502) 897-9861
Dimetcote 6	Ameron P.C.D., 201 N. Berry Street Brea, CA 92621, (714) 529-1951
Galvanox Type V	Subox Div., Carboline Co., 40 Burlews Court Hackensack, NJ 07601, (201)343-6533
Ganycin 347-931	DuPont, 1007 Market Street Wilmington, DE 19898, (302) 774-8279
Devoe/Napko 5Z 1375	Devoe/Napko, Napko Division, P.O. Box 14509, Houston, TX 77021, (713) 641-0661

2. Coatings, thinners and cleaners - Products of one manufacturer.

b. Finish Coat - Apply as specified on drawings.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

a. General

1. Before installation abrasive blast surfaces that will become inaccessible after installation, and faying surfaces that are part of slip-critical joints, and coat with inorganic zinc only.
2. Coat prepared surfaces within 6 hours after completion of surface preparation and before rusting or recontamination occurs. Reprepare surfaces not coated within 6 hours, or that show rusting or contamination, regardless of length of time after preparation.
3. Sequence surface preparation and coating operations so that freshly applied coatings will not be contaminated by dust or foreign matter.
4. Inspect and degrease surfaces as required before subsequent surface preparation and application of protective coatings. Perform degreasing by solvent cleaning, detergent washing, or steam cleaning. Conform to **SSPC SP 1** for solvent cleaning.

b. Abrasive Blasting

1. Conform to **SSPC SP 10**. Ensure that compressed air used for abrasive blasting is free of moisture and oil.
2. Do not blast following surfaces:
 - a) Galvanized steel and prefinished surfaces, except when specified to be blast-cleaned in coating schedule.
 - b) Piston rods and bearing surfaces.
3. Maintain a minimum nozzle pressure of **90 psi**.
4. Remove weld slag, weld spatter, and foreign matter from surfaces to be coated before abrasive blasting, using mechanical methods as specified.
5. Blast cleaning - Achieve a **0.012 in. to 0.002 in.** anchor profile, as indicated. Use scalers or abrasive disks or wheels in accordance with **SSPC SP 3**. Surface cleanliness - Conform to **SSPC SP 10**.

3.2 COATING APPLICATION

a. General

1. Use manufacturer's recommendations for thinning, mixing, handling, and applying product. If conflict exists between this specification and manufacturer's recommendations, this specification takes precedence.
2. Ensure that compressed air used for spraying coatings is free of moisture and oil.

3. Ensure that each coat of material applied is free of runs; sags; blisters; bubbles; mud cracking; variations in color, gloss, and texture; holidays; excessive film build; foreign contaminants; and dry overspray.
4. Do not apply coating when rain is imminent or when temperature or humidity is outside limits recommended by coating manufacturer.
5. To prevent moisture condensation during application, ensure that surface temperature is 37°F minimum above dew point.
6. Thoroughly work coatings into joints, crevices, and open spaces.
7. Adequately protect newly coated surfaces from damage.
8. Apply coatings by airless or conventional spray.

b. Mixing and Application Procedures

1. Stir material thoroughly with an instrument that will not induce air into coating.
2. Strain mixed material through a 0.024 in. to 0.012 in. mesh screen.
3. Agitate material continuously and slowly during application of inorganic zinc coatings to maintain uniform suspension. Avoid continuous rapid agitation.
4. Thin material for workability and improved spray characteristics only. Use only amount of thinner mix recommended by manufacturer.
5. Adjust spray equipment to produce an even, wet coat with minimum overspray.
6. Apply material in even, parallel passes, overlapping 50 percent. Ensure that welds, cutouts, sharp edges, rivets, crevices, and bolts receive proper coverage and thickness.
7. When used, keep pressure pot at same level as or above spray gun pressure for proper material delivery.
8. When dry through (dry to handle), check film thickness with a calibrated nondestructive dry-film thickness gage. If less than specified thickness, apply additional material as required. Obtain proper DFT for inorganic zinc coating in a single application, which may consist of multiple passes, while coating is still wet.

- c. Dry-Film Thickness - Apply inorganic zinc coating to a dry-film thicknesses of 0.0039 in. to 0.0059 in.

3.3 TOUCH-UP

Touch-up abrasions that occur during shipment or erection as follows:

- a. Prepare surface as specified herein.
- b. Use inorganic zinc for touch-up and repair of inorganic zinc and hot-dip galvanizing.

- c. Apply as specified herein.

3.4 CALKING

- a. For coating system, perform calking after application and curing of coating.
- b. Calk exterior joints, including joints in members between intermittent welds; perimeter of bearing surfaces between floor plates and supporting members (inside, outside, top, and bottom); stair treads, where joined to channel stringers; openings of 0.51 in. or smaller. Use foam filler backup as required.

3.5 INSPECTION

On-site work will be inspected by the Government for compliance with this specification.

-- End of Section --

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SECTION 15000

GENERAL MECHANICAL

08/06

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SECTION 15000

GENERAL MECHANICAL
08/06

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for general mechanical construction work, including plumbing, ductwork, and HVAC.

1.2 REFERENCES

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A13.1 Scheme for the Identification of Piping Systems

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM B766 Electrodeposited Coatings of Cadmium

FEDERAL SPECIFICATIONS (FS)

FF QQ-P-416 Plating, Cadmium (Electrodeposited)

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA)

SMACNA-91 Seismic Restraint Manual, Guidelines for Mechanical Systems

CALIFORNIA CODE OF REGULATIONS (CCR)

CCR Title 24 Section 6 Energy Efficiency Standards for Residential and Nonresidential Buildings

CALIFORNIA BUILDING STANDARDS COMMISSION

CPC California Plumbing Code

CMC California Mechanical Code

INTERNATIONAL STANDARD ORGANIZATION (ISO)

ISO 1940/1 (1986) Balance Quality Requirements of Rigid Rotor - Determination of Permissible Residual Unbalance

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

NEMA MG 1 (1993) Motors and Generators

1.3 QUALITY ASSURANCE

- a. Where materials and equipment are specified to conform to standards of Underwriters Laboratories, UL label or listing will be acceptable as sufficient evidence that items conform to Underwriters Laboratories requirements. Instead of such label or listing, the Contractor may submit a written certificate from any nationally recognized testing agency adequately equipped and competent to perform such services, stating that items have been tested and that units conform to specified requirements, and outlining methods of testing used.
- b. Where materials or equipment are specified to be constructed or tested, or both, in accordance with standards of American Society for Testing and Materials (ASTM), American Society of Mechanical Engineers (ASME), or other standards, a manufacturer's certificate of compliance of each item, or published catalog data certifying compliance, will be acceptable as proof of compliance.
- c. Conformance to such agency requirements does not relieve the Contractor from ensuring that items comply with other requirements of these specifications.
- d. Mechanical work shall comply with **CPC**, **CMC**, and **CCR Title 24, Section 6**. HVAC equipment shall include thermal insulation on ducts and pipes, unitary air conditioners and heat pumps, boilers, furnaces, water and air-cooled water chilling packages, and service water heaters.

1.4 MECHANICAL SYSTEMS IDENTIFICATION

- a. Identification Tags - Install identification tags of brass or aluminum indicating function of a valve, control or similar component on such system devices. Tags: **2 in.** diameter, stamped marking, wired to valve or equipment items with 12 ga stainless steel wire.
- b. Service Labeling in accordance with **ASME A13.1**. In addition:
 1. Label exposed piping, including pipe concealed in accessible spaces and insulated, bare, and painted pipe designating service and flow direction. Separately identify similar services with different temperatures or pressures. Provide labels for the following:
 - a) At each point of entry and exit of pipe passing through walls
 - b) At each change in direction, i.e., elbows, tees, in congested or hidden areas.
 - c) At all access panels to clarify service or indicated hazard.
 - d) In long straight runs; locate labels at distances within eyesight of each other, which shall not exceed **60 ft**.
 2. Label lettering: **2 in.** high. Where pipes, bare or insulated, are **2½ in.** outside diameter or less, attach labels on 16 ga. aluminum sheet to pipe with 12 ga. stainless steel wire. Ensure that labels are visible from primary service and operating area.
- c. Equipment Identification Plates
 1. Provide standard manufacturer's identification plates for each piece of equipment.

2. In addition to standard manufacturer's identification plates, provide engraved laminated phenolic identification plates for each piece of mechanical equipment. Identification plates designate function of equipment. Submit designation with shop drawings.
- e. Color Coding. The following colors shall be used in painting (color coding) of mechanical systems, piping, and equipment. Exact shades shall match existing colors and shades as designated by the Government.

<u>Description</u>	<u>Color</u>
Deaerator	silver (steam and hot water)
Natural gas	yellow
Steam system (supply and return)	gray (paint not required if insulated)
Hot water (supply and return)	gray (paint not required if insulated)
Make-up water	blue

Color coding (painting) of outside surface of piping insulation, lagging, or jacketing is not required. All components and piping shall be labeled with equipment or piping function, and direction of flow, self-stick-on labeling.

1.5 COORDINATION

Coordinate work of different trades so that interferences between piping, equipment, Ductwork, structural, and electrical work are avoided. Furnish offsets to avoid interferences.

1.6 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

- a. Design drawings are diagrammatic and do not show all offsets, bends, elbows, or other specific elements that may be required for proper installation of Work. Provide additional bends, offsets, and pipe required by vertical and horizontal equipment, fixture locations, or other job conditions to complete Work at no additional cost to the Government.
- b. Provide, and keep up-to-date, a complete record set of drawings showing every change in red from original specifications and drawings; obtain prints from COTR; keep this set of prints on Worksite, and use only as a record set. Record set will be retained by the Government.

1.7 PREVENTION OF CORROSION

- a. Protect metallic materials against corrosion. Give equipment enclosures rust-inhibiting treatment, and provide standard finish.
- b. Do not use aluminum in contact with earth. Protect aluminum where connected to dissimilar metals by approved fittings, barrier material, or treatment.
- c. Ferrous parts such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of stainless steel or nonferrous materials - Hot-dip galvanized in accordance with ASTM A123 for exterior locations, and cadmium-plated in accordance with ASTM B766 or FS QQ-P-416 for

interior locations.

1.8 MEASUREMENTS AND MEASUREMENT DATA

When measurements or surveys are required by a contract clause, the contractor shall furnish to the government the following information concerning the equipment used to make the specified measurements.

- a. Test Equipment - List of all test equipment used, including manufacturer, model number, serial number, calibration date, certificate of calibration, and special personnel qualifications required.
- b. Equivalency - If the contractor uses an equivalent test or procedure to meet the requirements of the contract specification, the contractor shall provide to the government proof of equivalency.

PART 2 PRODUCTS

2.1 ANCHORAGE

- a. Where anchorage details are not indicated, field installation is subject to approval by COTR.
- b. Proof load tests for expansion type anchor bolts loaded in pullout or shear.
 1. Ensure that bolts have ICBO approval.
 2. Test 50 percent of bolts (alternate bolts in any ground arrangement) in tension to twice allowable tensile load.

2.2 FINISHES

Provide factory-finished equipment. Methods and materials for any field retouching are subject to approval by the COTR.

PART 3 EXECUTION

3.1 INSTALLATION

- a. Install materials and equipment as indicated and in accordance with manufacturer's approved recommendations, International Conference of Building Officials (ICBO) Uniform Mechanical Code, Uniform Plumbing Code, and Uniform Building Code, whichever is more stringent. Perform installation so that there is no degradation of designated fire ratings of walls, partitions, ceilings, and floors.
- b. No installation shall be permitted which blocks or otherwise impedes access to any existing machine or system. All hinged doors shall swing open a minimum of 120 degrees. The area in front of all access doors shall be clear a minimum of 3 feet. The area in front of all access doors to electrical circuits shall be clear the minimum distance to energized circuits as specified in OSHA Standards, part 1910.333 (Electrical-Safety Related work practices) and an additional 3 feet.
- c. Except as otherwise indicated, emergency switches and alarms shall be installed in conspicuous locations. All gauges, meters, and alarms shall be mounted for easy visibility by people in the area.

3.2 CUTTING AND PATCHING

Install Work so as to require a minimum of cutting and patching of building structure. Holes in exposed locations, in or through existing floors and walls - Drill and smooth by sanding. Use a jackhammer only where specifically approved by COTR.

3.3 CLEANING

- a. Thoroughly clean exposed surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction before such surfaces are prepared for final finish painting or are enclosed within building structure.
- b. Before final acceptance, ensure that mechanical equipment and piping, is clean and free from dirt, grease, and finger marks.

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SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS

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SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS
08/06

PART 1 GENERAL

1.1 SUMMARY

This section specifies standard basic mechanical work.

1.2 REFERENCES

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC S328 Specification for Structural Steel Buildings - Load and Resistance Factor Design

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B40.1 Gauges - Pressure Indicating Dial Type - Elastic Element

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.19.2M Vitreous China Plumbing Fixtures

ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings

ASME B16.3 Malleable-Iron Threaded Fittings

ASME B16.5 Pipe Flanges and Flanged Fittings

ASME B16.9 Factory-Made Wrought Steel Buttwelding Fittings

ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B16.25 Buttwelding Ends

ASME B16.26 Cast Copper Alloy Fittings for Flared Copper Tubes

ASME B16.39 Malleable Iron Threaded Pipe Unions, Classes 150, 250, and 300

ASME B31.1 Power Piping

ASME B31.3 Chemical Plant and Petroleum Refinery Piping

ASME B36.10M Welded and Seamless Wrought Steel Pipe

ASME-16 Boiler and Pressure Vessel Code; Section

VIII, Pressure Vessels Division 1 - Basic Coverage

ASME-17 Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A6M General Requirements for Rolled Structural Bars, Plates, Shapes, and Sheet Piling

ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

ASTM A74 Cast Iron Soil Pipe and Fittings

ASTM A105M Forgings, Carbon Steel, for Piping Components

ASTM A126 Gray Iron Castings for Valves, Flanges, and Pipe Fittings

ASTM A183 Carbon Steel Track Bolts and Nuts

ASTM A197M Cupola Malleable Iron

ASTM A216M Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

ASTM A234M Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

ASTM A278M Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 662°F

ASTM A312M Seamless and Welded Austenitic Stainless Steel Pipes

ASTM A480M General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

ASTM A563M Carbon and Alloy Steel Nuts

ASTM B32 Solder Metal

ASTM B62 Composition Bronze or Ounce Metal Castings

ASTM B88M Seamless Copper Water Tube

ASTM B370 Copper Sheet and Strip for Building Construction

ASTM B749 Lead and Lead Alloy Strip, Sheet, and Plate Products

ASTM C67 Sampling and Testing Brick and Structural

	Clay Tile
ASTM C109	Compressive Strength of Hydraulic Cement Mortars (Using 2-in. Cube Specimens)
ASTM C190	Tensile Strength of Hydraulic Cement Mortars
ASTM C404	Aggregates for Masonry Grout
ASTM C476	Grout for Masonry
ASTM C564	Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C920	Elastomeric Joint Sealants
ASTM D2000	Standard Classification System for Rubber Products in Automotive Applications
ASTM E1	ASTM Thermometers
ASTM F104	Standard Classification System for Nonmetallic Gasket Materials
ASTM F568	Carbon and Alloy Steel Externally Threaded Metric Fasteners
AMERICAN WELDING SOCIETY (AWS)	
AWS A5.8	Filler Metals for Brazing and Braze Welding
AWS WHB-2	Welding Handbook, Volume 2
FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)	
FM P7825	Approval Guide
FEDERAL SPECIFICATIONS (FS)	
FS FF-S-325	Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
FS HH-I-558	Insulation, Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Thermal Fiber, Industrial Type)
MILITARY SPECIFICATIONS (MS)	
MS MIL-C-18480	Coating Compound, Bituminous, Solvent, Coal-Tar Base
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-58	Pipe Hangers and Supports - Materials, Design and Manufacture

MSS SP-67	Butterfly Valves
MSS SP-69	Pipe Hangers and Supports - Selection and Application
MSS SP-70	Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-72	Ball Valves with Flanged or Butt-Welding Ends for General Service

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA)

SMACNA-91	Seismic Restraint Manual, Guidelines for Mechanical Systems
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1.3 GENERAL REQUIREMENTS

Section 15000, General Mechanical, applies to work specified in this section.

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01300, Submittals:

SD-01, Data

[Equipment Foundation Data for Piping Systems](#) shall include plan dimensions of foundations and relative elevations, equipment weight and operating loads, horizontal and vertical loads, horizontal and vertical clearances for installation, and size and location of anchor bolts.

SD-01, Data

[Manufacturer's Catalog Data](#) shall be submitted for the following items:

1. Pipe and fittings
2. Piping specialties
3. Valves
4. Miscellaneous materials
5. Supporting elements
6. Spare parts
7. Motors

SD-04, Drawings

[Coordination Drawings](#) shall be submitted for pipes, valves, and specialties showing the physical layout of all components and coordination of work between different trades and with the structural and architectural elements of work. Drawings shall be in sufficient detail to show overall dimensions of related items, clearances, and relative locations of work in allotted spaces. Drawings shall indicate where conflicts or clearance problems exist between various trades.

SD-04, Drawings

As-Built Drawings shall be submitted for pipes, valves, and accessories providing current factual information including deviations and amendments to the drawings, and concealed and visible changes in the work.

SD-07, Schedules

Material, Equipment, and Fixture Lists shall be submitted for pipes, valves, and specialties including manufacturer's style or catalog numbers, specification and drawing reference numbers, warranty information, and fabrication site information. A complete list of construction equipment to be used shall be provided.

SD-09, Reports

Test Reports on the following tests shall be submitted for pipes, valves, and specialties.

1. Hydrostatic tests
2. Air tests
3. Valve-operating tests
4. Drainage tests
5. Pneumatic tests
6. Non-destructive electric tests
7. System operation tests

SD-19, Operation and Maintenance Manuals

Operation and Maintenance Manuals shall be consistent with manufacturer's standard brochures, schematics, printed instructions, general operating procedures and safety precautions. Test data shall be legible and of good quality.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS as specified elsewhere

2.2 PIPING SPECIALTIES

a. Air Vents

1. Manual air vents shall be 0.4 in. globe valves.
2. Automatic air vents on pumps, mains, and where indicated shall be of ball-float construction. Vent inlet shall be not less than $\frac{3}{4}$ in., and the outlet shall be not less than 0.3 in. Orifice shall be 0.1 in. Trim shall be corrosion-resistant steel conforming to **ASTM A480M**. Vent shall be fitted with try-cock. Vent shall discharge air at any pressure to 189 psi. Outlet shall be copper tube routed.

b. Dielectric Connections - Dissimilar pipe metals shall be electrically insulated from each other by couplings, unions, or flanges commercially manufactured for that purpose and rated for the service pressure and temperature.

c. Pressure Gages

1. Pressure gages shall conform to **ANSI B40.100** and to requirements

specified herein. Pressure gages shall be Type I, (for air, steam, and water) Class 1 (pressure). Case shall be corrosion-resistant steel, conforming to any of the **AISI 300** series of **ASTM A6M**, with an ASM No.4 standard commercial polish or better. Gages shall be equipped with adjustable red marking pointer and damper-screw adjustment in inlet connection. Service-pressure reading shall be at midpoint of gage range. Gages shall be equipped with gage isolators. Gages shall have dual (metric/English) scales.

2. For steam piping, gages shall be fitted with black steel siphons and steam service pressure-rated gage cocks or valves.

d. Thermometers - Thermometers shall conform to ASTM E1. Thermometers shall be industrial pattern Type I, except red organic-liquid-filled, Class 3 (well-threaded and seal-welded). Thermometers installed 6 ft or higher above the floor shall have an adjustable angle body. Scale shall be not less than 7 in. long. Case face shall be manufactured from manufacturer's standard polished aluminum or **AISI 300** series polished corrosion-resistant steel. Thermometer range shall be as indicated and shall have dual (metric/English) scales. Thermometers shall be provided with nonferrous separable wells. Lagging extension to accommodate insulation thickness shall be provided.

2.3 VALVES (unless otherwise noted on plans)

a. Drain, Vent, and Gage Cocks

1. Drain, vent, and gage cocks shall be lever handle, ground key type, with washer and screw, constructed of polished **ASTM B62** bronze, and rated 125 psi wsp. End connections shall be rated for specified service.

b. Standard Check Valves (SCV)

1. Standard check valves in sizes 2 in. and smaller shall be 125 psi swing check conforming to **MSS SP-72**, except as otherwise specified. Lift checks (lift check horizontal) and 125 psi, conforming to **MSS SP-72**, shall be provided where indicated. Swing-check pins shall be nonferrous and suitably hard for the service. Discs shall be composition type. Swing-check angle of closure shall be manufacturer's standard unless a specific angle is needed.

2. Check valves in sizes 2½ in. and larger shall be cast iron, bronze trim, swing type. Valve bodies shall be cast iron, conforming to **ASTM A126**, Class A. Valve ends shall be flanged in conformance with **ASME B16.1**. Swing-check pin shall be **AISI Type 304** or approved equal corrosion-resistant steel. Angle of closure shall be manufacturer's standard unless a specific angle is needed. Valves shall have bolted and gasketed covers.

2.4 MISCELLANEOUS MATERIALS

a. Bituminous Coating

1. Bituminous coating shall be a solvent cutback, heavybodied material to produce not less than a 0.01 in. dry-film thickness in one coat, and shall be as recommended by the manufacturer to be

compatible with factory-applied coating and rubber joints.

2. For previously coal-tar coated and uncoated ferrous surfaces underground, bituminous coating shall be solvent cutback coal-tar type conforming to MS MIL-C-18480.
 - b. Bolting - Flange and general purpose bolting shall be hex-head and shall conform to ASTM F568, Class 4.8 or above (bolts, for flanged joints in piping systems where one or both flanges are cast iron). Heavy hex-nuts shall conform to ASTM A563M. Square-head bolts and nuts are not acceptable. Threads shall be coarse-thread series.
 - c. Elastomer Calk - Polysulfide- or polyurethane-base elastomer calking material shall be two-component type conforming to ASTM C920.
 - d. Flashing
 1. Sheet lead shall conform to ASTM B749, Grade B (intended for use in laboratories and shops in general application).
 2. Sheet copper shall conform to ASTM B370 and shall be of not less than 1 lbs/ft² mass.
 - f. Flange Gaskets - Compressed non-asbestos sheet conforming to ASTM F104, Type 7-P1161A, coated on both sides with graphite or similar lubricant, with nitrile composition, binder rated 750°F.
 - g. Grout - Shrink-resistant grout shall be premixed and packaged metallic-aggregate, mortar-grouting compound conforming to ASTM C404 and ASTM C476, with the following properties:
 1. Tensile strength ASTM C190 1900 psi, minimum
 2. Compressive strength ASTM C109 14,000 psi, minimum
 3. Shrinkage, linear 0.3 percent, maximum
 4. Water absorption ASTM C67 0.1 percent, maximum
 5. Bond strength to 1001, minimum
steel in shear
 - h. Pipe Thread Compounds - Tetrafluoroethylene tape 0.002 in. to 0.003 in. thick shall be used in potable and process water and in chemical systems for pipe sizes to and including 1 in. Tetrafluoroethylene dispersions and other suitable compounds may be used for all other applications upon approval; however, no lead-containing compounds may be used in potable water systems.
- 2.5 SUPPORTING ELEMENTS (unless otherwise noted on drawings)
- a. Necessary piping systems and equipment supporting elements shall be provided including, but not limited to, building structure attachments; supplementary steel; hanger rods, stanchions, and fixtures; vertical pipe attachments; horizontal pipe attachments; anchors; guides; and spring-cushion, variable, or constant supports. Supporting elements shall be suitable for stresses imposed by systems pressures and temperatures and natural and other external forces normal to this facility without damage to supporting element system or to work being

supported.

- b. Supporting elements shall be UL listed and conform to ASME B31.3, FM P7825, FS FF-S-325, MSS SP-58, and MSS SP-69 except as noted.
 - c. Attachments welded to pipe shall be made of materials identical to that of pipe or materials accepted as permissible raw materials by referenced code or standard specification.
 - d. Supporting elements exposed to weather shall be hot-dip galvanized. Materials shall be of such a nature that their apparent and latent-strength characteristics are not reduced due to galvanizing process. Supporting elements in contact with copper tubing shall be electroplated with copper.
 - e. Type designations specified herein are based on MSS SP-58 and MSS SP-69. Masonry anchor group-, type-, and style-combination designations shall be in accordance with FS FF-S-325. Support elements, except for supplementary steel, shall be cataloged, load rated, commercially manufactured products.
 - f. Building Structure Attachments
 - 1. Anchor Devices, Concrete and Masonry
 - a) (1) Group I - Shield, expansion (lead, bolt and stud anchors)
 - (2) Group II - Shield, expansion (bolt anchors)
 - Type 2 - Machine bolt expansion shield anchors
 - Class 2 - Open-end expansion shield anchors
 - Style 1 - Single-end expansion shield anchors
 - Style 2 - Double-end expansion shield anchors
 - (3) Group III - Shield, expansion (self-drilling tubular expansion shell bolt anchors)
 - (4) Group VIII - Anchors, expansion (nondrilling)
 - b) Cast-in, floor mounted, equipment anchor devices shall provide adjustable positions.
 - c) Masonry anchor devices shall be built-in.
 - d) Powder-actuated anchoring devices shall not be used to support any mechanical systems components.
 - 2. Beam Clamps
 - a) Beam clamps shall be center-loading Type 21, 28, 29, 30, UL listed, cataloged and load-rated commercially manufactured product.
 - b) When it is not possible to use center-loading beam clamps, eccentric-loading beam clamps, Type 20 may be used for piping sizes DN50 and less. For pipe sizes over 2 in., provide two counterbalancing clamps per point of pipe support. Where more than one rod is used per point of pipe support, rod diameter shall be determined in accordance with referenced standards.
 - 3. C-Clamps - C-clamps shall not be used.
- g. Horizontal Pipe Attachments

1. Single Pipes
 - a) Piping in sizes to and including 2 in. shall be supported by Type 6 solid malleable iron pipe rings, except that split-band-type rings may be used in sizes up to DN25.
 - b) Piping in sizes above 2 in. through 8 in. inclusive shall be supported by Type 1 attachments.
 - c) Type 1 and Type 6 assemblies shall be used on vapor-sealed insulated piping, and shall have an inside diameter larger than pipe being supported to provide adequate clearance during pipe movement.
 - d) Use Type 12 devices with double-bolted angle-iron wall or fixture clips in pipe chases to support fixture supply piping.
 - e) Where thermal movement of a point in a piping system would cause a hanger rod to deflect more than 4 degrees from the vertical or where a horizontal point movement exceeds $\frac{1}{2}$ in., pipe rolls as indicated in details shall be used.
 - f) Type 40 shields shall be used on insulated piping. Area of the supporting surface shall be such that compression deformation of insulated surfaces does not occur. Longitudinal and transverse shield edges shall be rolled away from the insulation.
 - g) Insulated piping without vapor barrier on roll supports shall be provided with Type 39a saddles for pipe sizes to 12 in. and Type 39b for pipe sizes 12 in. and larger.
 - h) Spring supports shall be as indicated.
 2. Parallel Pipes - Trapeze hangers fabricated from approved structural steel shapes, with U-bolts, shall be used in congested areas and where multiple pipe runs occur. Structural steel shapes shall conform to supplementary steel requirements or be of commercially available, proprietary design, rolled steel.
- h. Vertical Pipe Attachments
1. Vertical pipe attachments shall be Type 8.
 2. Shop drawing data shall include complete fabrication and attachment details of any spring supports.
- i. Hanger Rods and Fixtures
1. Only circular cross section rod hangers may be used to connect building structure attachments to pipe support devices. Pipe, straps, or bars of equivalent strength shall be used for hangers only where approved.
 2. Turnbuckles, swing eyes, and clevises shall be provided as required by support system to accommodate temperature change, pipe accessibility, and adjustment for load and pitch. Rod couplings are not acceptable.
- j. Supplementary Steel - Where it is necessary to frame structural members

between existing members or where structural members are used instead of commercially rated supports, such supplementary steel shall be designed and fabricated in accordance with [AISC S328](#).

- k. Copper Tubing and Pipe Supports - Metal surfaces in contact with copper tubing or pipe shall be copper-plated or plastic-coated. Support surfaces shall have large contact areas to prevent point loading with consequent cutting.

PART 3 EXECUTION

3.1 PIPE INSTALLATION (unless otherwise noted on drawings)

- a. Piping systems shall be fabricated and installed in accordance with [ASME B31.3](#), [MSS SP-69](#), and [AWS WHB-2](#).
- b. Connections between steel piping and copper piping shall be electrically isolated from each other with dielectric unions or flanges with flange insulating kit rated for the service.
- c. Final connections to equipment shall be made with unions for sizes up to 2 in. and flanges for sizes 2½ in. and above, provided every 98 ft of straight run. Unions shall be provided in the line downstream of screwed- and welded-end valves.
- d. Pipe ends shall be reamed before joint connections are made.
- e. Screwed joints shall be made up with tetrafluoroethylene joint compound or tape, and not more than three threads shall show after joint is made up.
- f. Joint compounds shall be applied to the male thread only, and care shall be exercised to prevent compound from reaching the unthreaded interior of the pipe.
- g. Screwed unions, welded unions, or bolted flanges shall be provided wherever required to permit convenient removal of equipment, valves, and piping accessories from the piping system for maintenance.
- h. Piping systems shall be securely supported with due allowance for thrust forces, thermal expansion and contraction, and shall not be subjected to mechanical, chemical, vibrational or other damage as specified in [ASME B31.3](#).
- i. Field welded joints shall conform to [AWS WHB-2](#), [ASME B31.3](#), and [ASME-17](#).
- j. Piping systems butt weld joints shall be made without backing rings. Joint configuration shall conform to [ASME B16.25](#).
- k. Cutting of metallic piping shall be by wheel cutters or other machines designed specifically for that purpose. Electric-arc and oxyacetylene cutting is not permitted.
- l. Precautions shall be taken during installation of flexible pipe and hose including flushing/purging with water, steam, and compressed air to preclude bellows failure due to pipe line debris lodged in bellows. Installation shall conform to manufacturer's instructions.
- m. Assemble flanged joints with appropriate flanges, gaskets, and

bolting. Make clearance between flange faces such that connections can be gasketed and bolted tightly without imposing undue strain on piping system. Make flange faces parallel and bores concentric; gasket centered on flange faces without projecting into bore. Lubricate bolting with oil and graphite before assembly to ensure uniform bolt stressing. Draw up flange bolts and tighten in staggered sequence so as to prevent unequal gasket compression and deformation of flanges. After piping system has been tested and is in service at its maximum temperature, retighten bolting to achieve minimum gasket seating stress recommended by gasket manufacturer. Use only ASME B31.3 studs with nuts. Disassemble flange joints that fail pressure tests, correct the problem, then reassemble with new gaskets, studs, and nuts.

- n. Cut copper tubing or joints square and remove burrs with cutting and reaming tools. Clean inside surfaces of fittings and outside surfaces of tubes in joint area with steel wool before assembly of joint. Apply joint flux, solder, and heat source as recommended by manufacturer so as to provide proper capillary action to fill socket space and to achieve 100 percent shear-line strength. Valves in copper piping - screwed ends with end adapters to suit mechanical connections, unless solder jointing is specified or indicated for a given application. Remake copper joints that fail pressure tests with new materials, including pipe or tubing fittings and filler metal.

3.2 VALVES

- a. Valves shall be provided in piping mains and all branches and at equipment where indicated and as specified.
- b. Valves shall be provided to permit isolation of branch piping and each equipment item from the balance of the system.
- c. Riser and downcomer drains above piping shutoff valves in piping 2½ in. and larger shall be provided. Shutoff valve body shall be tapped and fitted with a ½ in. plugged globe valve.
- d. Valves unavoidably located in furred or other normally inaccessible places shall be provided with adequately sized access panels approved for the location.

3.3 SUPPORTING ELEMENTS INSTALLATION

- a. Supporting elements shall be provided in accordance with the referenced codes and standards.
- b. Piping shall be supported from building structure. No piping shall be supported from roof deck or from other equipment such as pipe, duct, or cable tray.

3.4 PENETRATIONS

- a. Penetrations shall be finished to be compatible with surface being penetrated. Seal exterior wall sleeves watertight, using mechanically expandable chloroprene inserts with mastic sealed metal components.

3.5 SLEEVES

- a. Sleeves shall be provided where piping passes through roofs, concrete walls and floors.

- b. Sleeves passing through steel decks shall be continuously welded or brazed to the deck.
- c. Sleeves that extend through floors, roofs, load bearing walls, and fire barriers shall be continuous and fabricated from Schedule 40 steel pipe, with welded anchor lugs. All other sleeves shall be formed by molded linear polyethylene liners or similar materials that are removable. Diameter of sleeves shall be sufficiently large to accommodate pipe, insulation, and jacketing without touching the sleeve, and shall provide a minimum 0.4 in. clearance. Sleeve size shall accommodate mechanical and thermal motion of pipe to preclude transmission of vibration to walls and the generation of noise.
- d. Space between a pipe, bare or insulated, and the inside of a pipe sleeve or a construction surface penetration shall be packed solid with a mineral fiber conforming to [FS HH-I-558](#), Form B, Type 1 (flexible blanket), Class 8, (451°F to 1000°F). This packing shall be provided wherever the piping passes through firewalls, equipment room walls, floors, and ceilings connected to occupied spaces, and other locations where sleeves or construction-surface penetrations occur between occupied spaces. Where sleeves or construction surface penetrations occur between conditioned and unconditioned spaces, the space between a pipe, bare or insulated, and the inside of a pipe sleeve or construction surface penetration shall be filled with an elastomer calk to a depth of $\frac{1}{2}$ in. Surfaces to be calked shall be oil- and grease-free.
- e. Exterior wall sleeves shall be calked watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed metal components.

3.6 FLASHINGS

Flashings shall be provided at penetrations of building boundaries by mechanical systems and related work.

3.7 UNDERGROUND PIPING INSTALLATION

- a. Before being lowered into a trench, piping shall be cleaned, visually inspected for apparent defects, and tapped with a hammer to audibly detect hidden defects.
- b. Suspect cast-ferrous piping shall be further inspected by painting with kerosene on external surfaces to reveal cracks.
- c. Defective materials found shall be distinctly marked using a road-traffic quality yellow paint; defective material shall be promptly removed from the site.
- d. After conduit has been inspected, and not less than 48 hours before being lowered into a trench, external surfaces of cast ferrous conduit shall be coated with a compatible bituminous coating for protection against brackish ground water. Application shall be single coat, in accordance with the manufacturer's instructions, to result in a dry-film thickness of not less than 0.01 in.
- e. Perform excavation and backfill operations as specified in Section [02200](#), Site Preparation and Earthwork. Excavations shall be dry and clear of

extraneous materials when pipe is being laid.

- f. Cutting of piping shall be by wheel cutters or other machines designed specifically for that purpose. Electric-arc and oxyacetylene cutting are not permitted.
- g. Laying of pipe shall begin at the low point of a system. When in final acceptance position, pipe shall be true to the grades and alignment indicated, with unbroken continuity of invert. Blocking and wedging are not permitted.
- h. Bell or grooved ends of piping shall point upstream.
- i. Changes in direction of drainage piping shall be made with long sweep fittings.
- j. Necessary socket clamping, piers, bases, anchors, and thrust blocking shall be provided. Rods, clamps, and bolting shall be protected with a coating of bitumen.
- k. On excavations that occur near and below building footings or foundations, the backfilling material shall consist of 2176 psi cured compressive-strength concrete poured or pressure-grouted up to the level of the footing.
- l. Metallic piping laid underground - Wrap in polyethylene. After pressure testing and before backfilling, thoroughly clean joints and valves and wrap or cover with heat-shrink tubing. Then test coated and wrapped pipe and valves with an electric holiday detector operating at 10 kV to 15 kV. Repair defects by clipping back coatings to bare metal and recoating as specified for original work, to the satisfaction of the COTR.
- m. Non-metallic underground piping shall have a copper tracer wire attached to the pipe.
- n. Valves - Install where indicated, set plumb, and centered on valves. Where feasible, locate valves outside traffic areas. Carefully tamp soil around each valve box to a distance of 4 ft on all sides of the box, or to undisturbed trench face if less than 4 ft. Protect valve boxes located in roads or sidewalks by a concrete slab as indicated.

3.8 DISINFECTION

Water piping, including valves, fittings, and other devices, shall be disinfected with a solution of chlorine and water. Solution shall contain not less than 50 parts per million (ppm) of available chlorine. Solution shall be held for not less than 8 hours, after which the solution shall contain not less than 10 ppm of available chlorine or the piping shall be re-disinfected. After successful sterilization, the piping shall be thoroughly flushed before placing into service. Flushing shall be complete when the flush water contains less than 0.5 ppm of available chlorine. Water for disinfection will be furnished by the Government. Contractor shall be responsible for approved disposal of contaminated flush water.

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DIVISION 15 -

SECTION 15400

PLUMBING

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SECTION 15400

PLUMBING

08/06

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for plumbing.

1.2 REFERENCES

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 1010 Drinking Fountain and Self Contained,
Mechanically Refrigerated Drinking Water
Coolers

Uniform Plumbing Code 2000

AMERICAN GAS ASSOCIATION (AGA)

AGA Z21.22 Relief Valves and Automatic Gas Shutoff
Devices for Hot Water Supply Systems

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A112.18.1M Plumbing Fixture Fittings

ANSI A112.19.1M Enameled Cast Iron Plumbing Fixtures

ANSI A112.19.2M Vitreous China Plumbing Fixtures

ANSI A112.19.3M Stainless Steel Plumbing Fixtures
(Designed for Residential Use)

ANSI A112.19.5 Trim for Water-Closet Bowls, Tanks, and
Urinals (Dimensional Standards)

ANSI Z358.1 Emergency Eyewash and Shower Equipment

ANSI Z53.1 Safety Color Code for Marking Physical
Hazards

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.6.1M Supports for Off the Floor Plumbing
Fixtures for Public Use

ASME A112.21.1M Floor Drains

ASME B1.20.7 Hose Coupling Screw Threads

ASME B1.21M Metric Screw Threads - MJ Profile

ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings
AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1010 Water Hammer Arresters
AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A126 Gray Iron Castings for Valves, Flanges,
and Pipe Fittings

ASTM A176 Stainless and Heat-Resisting Chromium
Steel Plate, Sheet, and Strip

ASTM B88M Seamless Copper Water Tube

ASTM C547 Mineral Fiber Preformed Pipe Insulation
AMERICAN WATERWORKS ASSOCIATION, INC. (AWWA)

AWWA C104 Cement-Mortar Lining for Ductile-Iron Pipe
and Fittings for Water

AWWA C500 Gate Valves for Water and Sewerage Systems

AWWA C506 Backflow Prevention Devices - Reduced
Pressure Principle and Double Check Valve
Types

AWWA C700 Cold Water Meters - Displacement Type,
Bronze Main Case
FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH
(FCCHR)

FCCHR-01 Manual of Cross-Connection Control
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-80 Bronze Gate, Globe, Angle and Check Valves
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54 National Fuel Gas Code
PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201 Water Hammer Arrestors Standard
SOUTHERN BUILDING CODE CONGRESS INTERNATIONAL (SBCCI)

SBCCI-02 Standard Plumbing Code
CALIFORNIA BUILDING STANDARDS COMMISSION

CPC California Plumbing Code

1.3 DESIGN REQUIREMENTS

- a. Section 15000, General Mechanical, applies to work specified in this section.
- b. Plumbing systems shall be provided and shall include the waste systems, and all required fittings.

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01300, Submittals:

SD-04, Drawings

Installation Drawings shall be submitted for piping systems in accordance with paragraph entitled, "Pipe Installation", of this section.

SD-04, As-Built Drawings

Provide exact routing of lines, pipe material and sizes, and location of valves and equipment.

SD-09, Reports

Test Reports shall be submitted for hydrostatic pressure tests in accordance with paragraph 3.1.A, Tests.

PART 2 PRODUCTS

2.1 INDUSTRIAL WASTE AND STORM DRAIN

- a. Cleanouts (CO)
 1. Cleanouts shall be per CPC, Chapter 10, and shall be effectively gastight and watertight, sized to provide quick and easy access for pipe removal and rodding tools in their specific location.
 2. Cast-iron bodies shall be coated with manufacturer's standard material.
 - a) Type CO-1 for yard cleanouts set in concrete driveways, or heavy vehicular traffic areas. Cast-iron body and setscrew-adjustable housing with deep-set tractor-type cast-iron scoriated cover. Construction shall be heavy duty, suitable for AASHTO H-10 loading.

2.2 SUPPORTING ELEMENTS

As specified in Section 15050, Basic Mechanical Materials and Methods.

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILL

Excavation and backfill operations shall be performed as specified in Section 02200, Site Preparation and Earthwork.

3.2 TESTS

- a. Plumbing systems shall be tested to prove tightness of piping and connections and proper operation of equipment and fixtures.
- b. Hydrostatic tests shall be performed by completely filling the piping system with water and eliminating accumulation of air so that any leakage will be immediately apparent. Pressure shall be maintained until pipe under test has been examined, but in no case for less than 1 hour.
- c. Underground soil and waste piping shall be tested before backfilling. Testing shall be applied to the system in its entirety or in sections.
- d. When the entire system is tested, openings in the pipes shall be tightly closed except the highest opening, and the system shall be filled with water to the point of overflow.
- e. When the system is tested in sections, each opening except the highest opening of the section under test shall be tightly plugged, and each section shall be filled with water and tested with at least 4 psi water pressure. In testing successive sections, at least the upper 10 ft of the next preceding section shall be tested so that each joint or pipe except the uppermost 10 ft of the system has been submitted to a test of at least 4 psi water pressure. Water shall be kept in the system or in the portion under test for at least 2 hours before the inspection starts. System shall be proved tight at all joints.

3.3 UNDERGROUND PIPING

Non-metallic underground piping shall have a copper tracer wire attached to the pipe.

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SECTION 15990

TESTING, ADJUSTING AND BALANCING

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SECTION 15990

TESTING, ADJUSTING AND BALANCING
08/06

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for testing, adjusting and balancing of mechanical systems.

1.2 REFERENCES

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1 National Standards for Testing and
Balancing Heating, Ventilating, and Air
Conditioning Systems

AMERICAN SOCIETY OF HEATING REFRIGERATING, AND AIR CONDITIONING
ENGINEERS, INC. (ASHRAE)

ASHRAE-05 Handbook, HVAC Applications (SI Edition)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B40.1 Gauges - Pressure Indicating Dial Type -
Elastic Element

SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION,
INC. (SMACNA)

SMACNA-93 HVAC Systems - Testing, Adjusting and
Balancing

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01300, Submittals, in sufficient detail to show full compliance with the specification.

SD-01, Data

Equipment and Performance Data shall be submitted for instruments and equipment to be used during testing.

SD-09, Reports

Test Reports shall be submitted to the COTR for approval. Six bound copies of the testing, adjusting, and balancing report shall be provided.

SD-13, Certificates

Certificates of Compliance shall be submitted by the Contractor showing independent laboratory certification of test-apparatus calibration

data, dated after the award of the contract.

1.4 GENERAL REQUIREMENTS

Section 15000, General Mechanical, applies to work specified in this section.

PART 2 PRODUCTS

Products are not required for this section.

PART 3 EXECUTION

3.1 WATER SYSTEMS TESTING (except as noted on drawings)

- a. Before acceptance of the work, systems shall be tested in the presence of the COTR.
- b. Tests shall be performed before insulation of surfaces, painting, and concealment of work. Systems containing repaired defects shall be retested to original criteria for acceptance, except when waived by the COTR.
- c. Tests shall be hydrostatic, unless otherwise specified. Water used for testing shall be potable.
- d. Government will supply testing water, but the Contractor shall provide for approved disposal of contaminated water.
- e. Contractor may conduct tests for its own purposes, but the acceptance test shall be conducted as specified herein.
- f. If the test demonstrates that leakage rate exceeds specified limits, the sources of leakage shall be determined, defective materials and workmanship shall be repaired or replaced, and the system shall be retested until specified requirements are met.
- g. Other than standard piping flanges, plugs, caps, and valves, only commercially manufactured expandable-elastomer plugs shall be used for sealing off piping for test purposes. Safe test-pressure rating of any plug used shall be not less than two times the actual test pressure being applied.
- h. Precautions shall be taken to vent the expansive force of compressed air trapped during high-pressure hydrostatic testing to preclude injury and damage.
- i. Piping system components such as valves shall be checked for functional operation under system test pressure. Components that could sustain damage due to test pressure shall be removed from piping systems before hydrostatic testing.
- j. Leaking gasket joints shall be remade with new gaskets.
- k. Temperature of water used for testing shall not cause condensation on system surfaces.
- l. Test media shall not be added to a system during a test for a period specified or to be determined by the COTR.

- m. Duration of a test will be determined by the COTR and shall be for a minimum of 2 hours, with a maximum of 24 hours. Test may be terminated by direction of the COTR at any time during this period after it has been determined that the permissible leakage rate has not been exceeded.
 - n. Test records of piping systems tests shall be prepared and maintained. Records shall show test personnel responsibilities, dates, test gage identification number, ambient and test water temperatures, pressure ranges, rate of pressure drop, leakage rates, and other system characteristics.
 - o. Test Gages - Test gages shall have a 4½ in. or larger dial, be accurate to +/- 0.5 percent of full-scale range, and have dial graduations and pointer width compatible with readability and one-half the accuracy extremes. Maximum permissible scale range for a given test shall be such that the pointer shall have a starting position at midpoint of the dial or within the middle third of the scale range. Certification of accuracy and correction table shall bear a date within 90 days before use, test gage number, and project number.
 - p. Test and Acceptance Criteria
 - 1. Aboveground water systems shall be tested at 152 psi and the applied test pressure shall be maintained without further addition of test media for not less than 2 hours. Maximum allowable pressure drop shall be 2 psi, or as approved.
 - 2. Maximum allowable leakage for the piping installation shall be indicated by not more than a 1 percent drop of total system pressure.
 - 4. Hydrostatic tests shall be applied only to piping with concrete thrust blocking that has cured for a minimum of 7 days.
- 3.2 STEAM AND CONDENSATE SYSTEMS TESTING (except as noted on drawings)
- a. Before acceptance of the work, completed systems shall be tested in the presence of the COTR.
 - b. System shall be subjected to pressure tests to determine structural integrity, and to operational and cyclic tests, as necessary, to determine that system functions and operates as required.
 - c. After pressure tests and cleaning operations have been satisfactorily completed, system components shall be adjusted for proper operation within the design and operating characteristics published by the component manufacturer. In addition to the services of an authorized representative of the manufacturer, the Government reserves the right to require the services of an authorized representative of a component manufacturer if the Contractor is unable to adjust a component. Contractor shall arrange for such services and defray the cost.
 - d. Test Duration
 - 1. Duration of a test will be determined by the COTR.
 - 2. A pressure test shall be held for a minimum of 2 hours and a maximum of 24 hours.

3. An operational test shall be held for a minimum of 6 hours and a maximum of 24 hours.
 4. A test may be terminated by the COTR at any time after it has been determined that the system meets specified requirements.
- e. Test Gages - Contractor's test gages shall conform to ASME B40.1 and shall have 0.79 in. or larger dials. Maximum permissible scale range for a given test shall be such that the pointer shall have a starting position at midpoint of the dial or within the middle third of the scale range. Certification of accuracy and correction table shall bear a date within 90 days before use, test gage number, and project number.
- f. Acceptance Pressure Testing
1. Testing shall take place during steady-state ambient temperature conditions.
 2. Tests shall be hydrostatic unless otherwise specified.
 3. Subject to prior approval, tests may be pneumatic. Personnel not directly involved in pneumatic testing of piping in excess of 5 psi shall be evacuated from the area.
 4. Pneumatic testing shall include swabbing joints under test pressure of 5 psi with standard high-film-strength soap solution and observing for bubbles.
 5. Tests of steam and condensate systems shall be made using potable water.
 6. Compressed air used for steam and condensate systems pneumatic testing shall be oil-free.
 7. Systems shall be tested at 1.5 times primary working steam pressure rating of system components, and the applied pressure shall be maintained without further addition of test media for not less than 1 hour. Maximum allowable pressure drop shall be 1 psi, or as approved.
 8. Contractor may conduct tests for its own purposes, but the acceptance test shall be conducted as specified herein.
 9. If testing reveals that leakage exceeds specified limits, the leaks shall be isolated and repaired, defective materials shall be replaced where necessary, and the system shall be retested until specified requirements are met. Leaking gasket joints shall be remade with new gaskets and new flange bolting. Old gaskets and bolting shall be discarded. Leaking tubing joints shall be remade with new fittings and new tube ends.
 10. Other than standard piping flanges, plugs, caps, and valves, only commercially manufactured expandable elastomer plugs shall be used for sealing off piping for test purposes. Safe test-pressure rating of any plug used shall be not less than two times the test pressure.
 11. Precautions shall be taken when venting compressed air trapped

during high-pressure hydrostatic testing to preclude injury and damage. If adequate purging or vent valves are not provided to ensure removal of compressed-air cushion, the COTR may require the removal of any system component such as plug and caps to ascertain that the water has reached all parts of the system. Components shall be removed from piping systems before hydrostatic testing whenever the components could be damaged by shock or test pressure.

12. Movement limiting provisions shall be used to protect expansion joints against overextension from system pressures.
 13. Piping system components, such as valves, shall be checked for functional operation under system test pressure.
 14. Piping shall be subjected to shock developed by a vigorously applied 2 lb hammer, as directed by the COTR.
 15. Temperature of water used for testing shall not cause condensation on system surfaces.
- g. Operational Testing - System shall be cycled five times, from start to operating thermal conditions, to verify adequacy of construction, system controls, and component performance, unless otherwise approved.

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DIVISION 16 -

SECTION 16000

GENERAL ELECTRICAL

08/06

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-- End of Section Table of Contents --

SECTION 16000

GENERAL ELECTRICAL
08/06

PART 1 GENERAL

1.1 SUMMARY

This section specifies requirements for wiring materials and methods for interior electrical construction, and grounding of electrical systems and equipment including ground rods, grounding conductors, and connectors.

1.2 REFERENCES

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI C80.3 Electrical Metallic Tubing

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B3-01 Soft or Annealed Copper Wire

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC. (IEEE)

IEEE 81 Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 100 Volts Maximum

NEMA PB 1 Panelboards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 National Electrical Code

NFPA 72 National Fire Alarm Code

NFPA 70E Standard for Electrical Safety in the Workplace

UNDERWRITERS LABORATORIES INC. (UL)

UL 489 Molded-Case Circuit Breakers and Circuit-Breaker Enclosures

UL 506 Specialty Transformers

UL 514A Metallic Outlet Boxes

UL 797 Electrical Metallic Tubing

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION

NETA - ATS

Acceptance Testing Specifications

1.3 SUBMITTALS

Refer to Section 01300, Submittals. Submit the following:

[SD-01, Manufactures Catalog Data](#)

[Manufactures Catalog Data](#) for electrical equipment and fixtures.

[SD-04, As-Built Drawings](#)

Indicate precise routing of raceways, and location of panel boards, switches, wiring devices, ground rods, mats, grids, building ground bus, supplementary grounding electrodes, and metal structures connected to grounding system. One-line drawings shall be provided showing current path from the building Main Distribution Panel (MDP) to circuit breaker panel(s) and to the actual loads. A drawing template will be provided for this purpose. Outlets and other loads shall be labeled to identify the associated panel and breaker. Circuit breaker rating and actual load for each breaker shall be defined on the panel schedule drawing. Existing as-built drawings shall be updated as appropriate for electrical modifications. If extensive modifications require new as-built drawings, notes shall be added to both drawings to cross-reference both the old as-built drawings and the new. Drawings shall conform to the following Ames Specifications:

1. A013-8901-XR1 Ames Engineering Document Number System
2. NASA Ames Facility Engineering Branch AutoCAD Drawing Requirements dated 21 June 2000.
3. NASA Ames Facility Engineering Branch AutoCAD Drawing Revision Requirements dated 26 May 2000.
4. Instructions for completing and submitting an Engineering Change Order (ECO) Form.

[SD-06, Manufacturer's Instructions](#)

[Manufacturer's Instructions](#) for such items as control devices, transformers, switches and circuit breakers.

[SD-07, Material Schedule](#)

[Material Schedule](#) for materials not covered by SD-01.

[SD-09, Test Reports](#)

[Test Reports](#) on tests specified to be conducted by Contractor, in accordance with the latest NETA standard.

[SD-13, Certificates](#)

[Certificates of Compliance](#) on products required to conform to UL, FM, ASTM, ANSI, NFPA, or other commercial listing requirements, when a label is not provided on product.

1.4 QUALITY ASSURANCE

- a. Approval of materials and equipment will be based on UL, NEMA, ANSI, ASTM, NFPA, or other commercial standards.
- b. Equipment design, fabrication, and installation - Unless indicated otherwise, comply with NFPA 70 and referenced codes and standards.
- c. Do not cover up or enclose work until it has been inspected, tested, and approved. Uncover any work that is enclosed or covered up before being inspected and tested and, after work has been inspected and approved, restore to its original condition at no additional cost.

1.5 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

- a. Design drawings are diagrammatic and do not indicate all offsets, bends, elbows, or other specific elements that may be required for proper installation of work. Accomplish such work at worksite. Provide additional bends, offsets, and conduit as required to complete work at no additional cost.
- b. Locations of switches, receptacles, lights, motors, outlets, and other equipment indicated are approximate. Place such items so as to not interfere with ducts, piping, and equipment. Verify door swings so that light switches are properly located.
- c. Equipment sizes shown on drawings are minimum unless otherwise indicated. Before installing any wire or conduit, obtain exact equipment requirements and install items such as wire, conduit, disconnect switches, motor starters, heaters, and circuit breakers of correct size for equipment actually installed; however, do not use wire and conduit sizes smaller than those indicated without written approval.

1.6 COORDINATION

- a. Coordinate electrical work with work of other trades.
- b. Conduct operations so as to minimize interference with electric service to existing structures. Obtain specific approval before interrupting any existing service, either momentarily or for extended periods of time. When such work is contemplated, notify COTR at least 10 working days in advance of time such work is planned; do not proceed with work until approval has been given for interruption of service during time requested.

1.7 PREVENTION OF CORROSION

Protect metallic materials against corrosion. Equipment enclosures - Provide standard manufacturer's finish. Do not use aluminum in contact with earth. Where connected to dissimilar metal, protect aluminum with approved fittings and treatment. Ferrous metals such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel - Hot-dip galvanized except where other equivalent protective treatment is specifically approved in writing.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Standard cataloged products of manufacturers regularly engaged in supplying electrical materials and equipment; conforming to requirements specified herein; suitable for installation indicated; and representative of products that have been in satisfactory use for at least two years.

2.2 CONDUITS, RACEWAYS, AND FITTINGS

a. General

1. Use rigid steel conduit (RSG) in conduit systems, except where otherwise indicated and where flexible conduit is required.
2. Conduit size: $\frac{3}{4}$ in. (RSC) diameter minimum for above ground and 2 inches PVC for below ground for general power and lighting application, except where specifically indicated smaller and for switch leg runs.
3. Rigid aluminum conduit is permitted instead of rigid steel conduit in sizes 2 in. and larger for indoor locations.
4. Conduit and raceway runs concealed in or behind walls, above ceilings, or exposed on walls and ceilings 60 in. or more above finished floors and not subjected to mechanical damage may be electrical metallic tubing.
5. Conduit, connectors, and fittings - Approved for installation of electrical conductors.

b. Rigid Metal Conduit - Use threaded fittings.

c. Rigid Plastic Conduit - PVC Schedule 40, minimum; slip-joint solvent-weld type. Fittings - Unthreaded solid PVC.

d. Electrical Metallic Tubing (EMT) - ANSI C80.3 and UL 797; rigid metallic conduit of thinwall type in straight lengths, elbows, or bends.

e. Flexible Metallic Conduit

1. Fittings - UL labeled.
2. Liquidtight flexible metallic conduit - Provide with a protective jacket of PVC extruded over a flexible interlocked galvanized steel core to protect wiring against moisture, oil, chemicals, and corrosive fumes.

2.3 WIRE AND CABLE

a. Building Wire

1. Conductors - Standard concentric stranded copper wire; minimum #12 AWG except that #14 AWG may be used for control wiring where indicated.
2. Building wire (600 Volts and below) - Type THHN/THWN, insulation of PVC and nylon jacket, with a minimum temperature rating of 194°F.

- b. Switchboard Wire - Use for instrument and control wiring on back of switchboards and hinged-front instrument panels; single-conductor, 600 V, flame- and heat-resistant insulated wire, minimum #14 AWG with a minimum temperature rating of 194°F. Current and voltage transformer wire, 600 V or less - Type SIS, #12 AWG and #10 AWG, type SIS for current transformers.
- c. Power and Control Wire in Cable Trays - Type TC cable (approved for cable tray installation), 600 V, with current-carrying capacity as determined by NFPA 70.
- d. Standard Flexible Multiconductor Cable - For control and power below 600 V; contains one (green) grounding conductor; thermosetting or thermoplastic overall jacket (Type SJ, SJO, SO, STO). Include white conductor for power neutral (grounded current-carrying conductor).
- e. Splices and Connectors
 - 1. When splicing in building wire #8 AWG and smaller and multiple conductor cables with insulated Scotchlock, or equal, connectors or with indentor crimp-type connectors and compression tools.
 - 2. When splicing in building wire #6 AWG and larger use indentor crimp-type connectors and compression tools, or bolted clamp-type connectors.
 - 3. Wrap joints with an insulating tape that has an insulation and temperature rating equivalent to that of conductor. Make splices in rubber-insulated neoprene-jacketed wire and cables watertight.
 - 4. Vinyl-plastic electrical insulating tape - Conform to UL, for intended application.
 - 5. Use compression lug in terminations where indicated and for building wire #8 AWG.

2.4 FLUSH WIRING DEVICES

- a. Wall Switches
 - 1. Where two or more snap switches will be installed at same location, mount them in one-piece ganged switch boxes, with a gang cover plate.
 - 2. Mount combination snap switch and single or duplex receptacles in two-gang switch boxes, with a combination two-gang cover plate.
- b. Receptacles - Provide 20 A, 125 V ac, two-pole, three-wire, single or duplex grounded, conforming to 5-20R configuration except where specific-purpose, locking, or higher rated receptacles are indicated or specified.
- c. Clock Outlets - Provide 15 A, 125 V ac, two-pole, three-wire, single polarized receptacle in a standard approved flush-mounted outlet box with a matching wall plate and a clock-mounting hook. Outlets - Recessed for plug caps that allow surface-mounted clocks to hang flush with finished wall.

- d. Floor Outlets - Provide convenience outlets in floors for connection to 120 V ac single-phase circuits, comprising single or duplex receptacles enclosed in floor boxes with cover plates especially approved for purpose.
- e. Weatherproof Outlets - Provide GFCI-type convenience outlets in outdoor damp or wet locations for connection to 120 V ac single-phase circuits, comprising single or duplex receptacles enclosed in weatherproof outlet boxes, with gasketed cast-aluminum plates and spring-loaded hinged lift covers. Springs and hinge pins - Corrosion-resistant steel. Screws and spring covers - Chromium- or cadmium-plated brass. Use rubber or neoprene gaskets to provide a positive seal against weather. Some areas may require ground fault circuit interrupter (GFCI) device.
- f. Device Plates
 - 1. Wall plates for flush snap switches and receptacles - Stainless steel, minimum 0.04 in. thick, with beveled edges and a brushed satin finish.
 - 2. Mounting screws - Stainless steel with oval countersunk heads finished to match plate.
- g. Occupancy Sensors - Where shown on drawings, provide occupancy sensors (such as those supplied by The Watt Stopper, Inc. or equal) that automatically control lighting based on room occupancy. Sensors shall be UL with adjustable sensitivity and time delay, in accordance with the latest UBC, title 24.

2.5 BOXES AND FITTINGS

- a. Boxes - Sufficiently large to accommodate conductors entering box, in accordance with [NFPA 70](#), and [UL 514A](#). Boxes exposed to weather or in normally wet locations - Cast-metal with threaded hubs and weatherproof covers.
- b. Outlet, switch, and junction boxes flush-mounted in walls or ceilings - Octagon, square, or rectangular-shaped gang boxes as appropriate, with extension rings and covers.

2.6 PANELBOARDS

- a. Lighting and appliance branch circuit panelboards - Circuit-breaker type in accordance with [NEMA PB 1](#). Circuit breakers - Bolted to bus; plug-in circuit breakers are not acceptable. Buses - Copper of the rating indicated, with main lugs or main circuit breaker as indicated.
- b. Panelboards for use on grounded ac systems - Provide with a full-capacity isolated neutral bus and a separate grounding bus bonded to panelboard enclosure.
- c. Panelboard enclosures - [NEMA 250](#), Type 1, according to [NEMA PB 1](#), unless otherwise indicated. Enclosure fronts - Provide latchable hinged doors (door-in-door construction).
- d. Arc Flash and shock hazard warning label shall be in accordance with [NFPA 70](#), Section 110.16 and [NFPA 70E](#).

2.7 CIRCUIT BREAKERS

Interrupting ratings to be not less than those indicated and in no event less than 14 kA (rms) symmetrical for systems of 240 volts or less and no less than 22KA (rms) symmetrical for systems of 480 Volts. Multipole circuit breakers - Common-trip type with a single handle. Molded case circuit breakers - Bolt-on type conforming to [UL 489](#).

2.8 LAMPS AND LIGHTING FIXTURES

- a. Manufacturers and catalog numbers shown are indicative of general type desired, and are not intended to restrict selection to fixtures of any particular manufacturer. Fixtures with same salient features and equivalent light distribution and brightness characteristics, and of equal finish and quality, are acceptable. Provide lamps of proper type and wattage for each fixture. Fixtures require approval by COTR before purchase.
- b. Ballasts - High power factor, energy efficient, UL listed, A-sound rated, with Class P terminal protective device for 120 V or 277 V operation as indicated, rapid-start fluorescent type. Fluorescent lamps - Standard reduced wattage type, General Electric Company Watt-Miser II or approved equal.
- c. Office lighting - Install lighting systems that comply with Title 24 California Code of Regulations, Part 6 energy efficiency requirements, <http://www.energy.ca.gov/title24/2005standards/index.html> including fluorescent T5 lighting fixtures with energy efficient electronic ballasts, multilevel lighting control, and occupancy sensors for auto-shut off.
- d. Warehouse lighting - For indoor warehouse lighting, install fluorescent T5HO high bay light fixtures or compact fluorescent alternative to metal halide or sodium pressure HID. Install occupancy sensors and bi-level switching for indoor warehouse lighting and light sensing controls for outdoor lighting. Alternative to HID products are listed at http://www.uslighting.us/uslighting_products_specialty.htm.

2.9 DRY-TYPE DISTRIBUTION TRANSFORMERS

General purpose, with 480 V primary windings, two-winding type, 60 Hz, self-cooled, conforming to UL 506. Provide primary windings with two 2.5 percent taps above and two below nominal voltage. Aluminum Windings are acceptable for transformers under 750 kVA.

2.10 GROUNDING SYSTEM COMPONENTS

- a. Ground Rods - Copper-clad or copper-coated steel rods, minimum $\frac{3}{4}$ in. diameter, minimum 120 in. long per section until resistance to ground is 25 ohms or less. Rods - Rolled to a commercially round shape from welded copper-coated steel, with a hard, clean, and smooth continuous copper surface. Ground rods - Sectional with a cone-shaped point on the first section, and die-stamped near top with name or trademark of manufacturer and length of rod in meters.
- b. Ground Wires - For substations, main panels and distribution points, and ground rod connections provide annealed bare copper ground wires conforming to [ASTM B3](#), stranded, with 98 percent conductivity. Size of wire - As indicated and, if not indicated, in accordance with grounding

requirements of **NFPA 70** and **IEEE 81**.

- c. Grounding Connectors - UL approved and labeled.

PART 3 EXECUTION

3.1 CONDUITS, RACEWAYS, AND FITTINGS

- a. Enclose power, lighting, control power, emergency light, emergency power, and special-service systems in separate conduit or separate conduit systems. Install conduit and fittings in accordance with **NFPA 70** and as specified herein.
- b. Provide rigid steel conduit and raceway runs in or under concrete; in damp, corrosive, or outdoor locations; in hazardous areas; where subjected to mechanical damage; or where intended for conductors rated over 600 V. Paint or wrap RSC with PVC tape at conduit joints in corrosive areas with corrosion- or acid-inhibiting compounds.
- c. For any run of EMT, intermediate, or rigid conduit between outlet and outlet, between fitting and fitting, between outlet and fittings, and for bends located immediately at outlet of fitting conform to **NFPA 70**. Ensure that installed conduit and fittings are free of dirt and trash and are not deformed or crushed.
- d. Install power and lighting conduit with a minimum of **3 in.** of free air space separation from mechanical and communication piping.
- e. Install concealed conduit in finished areas. Install conduit passing through walls in sleeves.
- f. Provide expansion fittings with flexible ground strap in conduit runs crossing building expansion joints.
- g. Seal exposed ends of conduit without conductors with watertight caps or plugs. Provide bushings on open ends of conduit containing conductors. Provide insulated bushings for conduits containing #4 AWG conductors or larger with an insulating ring as an integral part of bushing.
- h. Install a **¼ in.** nylon or polypropylene pull rope with a minimum tensile strength of 130 lbs. in empty conduits.
- i. Paint couplings, boxes, and conduit fittings on fire alarm systems with red paint and on FMCS with blue paint.
- j. Support of Conduit
 - 1. Clamp conduit securely and support at least every **10 feet** vertically and **8 ft** horizontally unless otherwise indicated. Support conduit in high vibration areas every **3 feet**, and in medium vibration areas every **5 ft**. Unless indicated otherwise, contact COTR for final verification of high and medium vibration areas. Fasten galvanized pipe straps to structure with bolts, screws and/or anchors. Do not use wooden masonry plugs.
 - 2. Do not support conduit or boxes from T-bar ceiling wires.
 - 3. Support conduit connections to boxes and fittings at **3 ft** maximum

from connection point. Support conduit bends at 3 ft maximum from each change in direction. Install conduit in neat symmetrical lines parallel to centerlines of building construction and building outline. Multiple runs - Parallel and grouped on common supports whenever possible.

4. Seal ends of conduit extending from interior to exterior of building and portions of interior conduit exposed to widely varying temperatures to prevent passage of air within conduit. Slope conduit to drain, and provide with drainage fittings at lower end of run. Ensure that curved portions of conduit bends are not visible above finished floor. Terminate in a pull box underground service entrance and feeder conduit entering or leaving the building above ground floor.

k. Flexible Conduit

1. Make electrical connections to vibration-isolated equipment with flexible metallic conduit so as to not impair function of equipment.
2. Use flexible metallic conduit to connect recessed fixtures from outlet boxes in ceilings, metallic transformers, and other approved assemblies.
3. Use liquid-tight flexible metallic conduits in wet and oily locations.
4. Provide sections of flexible steel conduit maximum 6 ft long and install only in exposed or accessible locations. Ensure that interior surfaces of conduit are free from burrs and sharp edges that may cause abrasion of wire and cable coverings. Provide ends of flexible steel conduit with grounding bushings and approved fittings.
5. Use ground wires in flexible conduit for circuits if it is 6 ft or longer. Flexible conduit is not considered to be a ground conductor.
6. Flexible Metallic Conduit - Install only in exposed, accessible locations in accordance with NFPA 70. Install grounding conductor (green) in all runs. Make connections to motors and vibrating equipment with flexible metallic conduit.

l. Rigid Metal Conduit

1. Ends of conduit - Cut square, ream and threaded. Bring joints butt-to-butt in couplings. Make joints mechanically tight. Protect conduit against damage and entrance of water or foreign material during construction.
2. Make 90-degree bends of conduit larger than 1 in. diameter with factory-made elbows. Provide long radius elbows for conduit larger than 2½ in. diameter. Make field-made bends and offsets with an approved hickey or conduit-bending machine. Make changes in direction of runs with symmetrical bends or cast-metal fittings. Maximum allowable 90 degree bends not to exceed 3 bends.
3. At connections to sheet metal enclosures and boxes, ensure that a

sufficient number of threads project through to permit bushing to be drawn tight against end of conduit; then pull up locknut sufficiently tightly to draw bushing into firm electrical contact with box. Fasten conduit to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulating bushings are used, where bushings cannot be brought into firm contact with box, and where indicated.

4. Make conduit joints with tapered thread firmly set. Ream each length of conduit cut in field before installation. Where conduit is threaded in field, ensure that each threaded end consists of at least five full threads. Use corrosion-inhibitive compound on conduit threads in exterior areas.
 5. Conduit stubbed-up through concrete floors for connections to free-standing equipment (except motor-control centers, cubicles, and other such items of equipment) - Provide with a flush coupling if floor slab is of sufficient thickness; if not, provide a floor box set flush with finished floor. Conduits installed for future use - Terminate with a coupling and plug set flush with floor, unless otherwise indicated.
- m. Rigid PVC Conduit (Schedule 40)
1. Rigid PVC conduit for underground work - Encase in a red-dyed concrete envelope or bury directly as specified for underground ducts. Where suitable protection is provided, PVC may be run exposed (particularly in high corrosion areas).
 2. Run continuous, bare, soft-drawn copper ground wire in conduit with phase conductors, and solidly connect to ground at each end. Size ground wires in accordance with NFPA 70.
 3. Store rigid PVC conduit on a flat surface and protect from direct rays of sun.
- n. EMT
1. Cut EMT square with hacksaw or three-wheel pipe cutter, and ream to remove burrs and rough surfaces.
 2. Avoid field-made bends and offsets where possible but, where necessary, make bends with an approved hickey or conduit-bending machine. Make changes in direction of runs with symmetrical bends or approved metal fittings.
- o. Any connection to alarm initiating devices shall be in accordance with NFPA 72.

3.2 INSTALLATION OF WIRING

- a. Completely install raceways with interiors clean, dry, and protected from weather before proceeding with installation of wires and cables. Ensure that conductors of special-service systems and emergency light and power systems do not occupy same enclosure with light and power conductors, or same enclosure with each other. Ensure that conductors are continuous, with splices and connections made in outlet, junction, or pull boxes only.

- b. Conductors 600 V and below - Color coded in accordance with the following:

CONDUCTOR	120/208/240 V	277/480 V
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	White
Equipment Grounds	Green	Green

- c. Conductors up to and including #2 AWG shall be manufactured with colored insulating materials. Conductors larger than #2 AWG shall be - Ends identified with colored plastic tape in outlet, pull, or junction boxes. Identify control circuit conductors at each connection point.
- d. Connectors and splices - Conform to UL and make in approved enclosures using solderless pressure connectors and vinyl-plastic electrical insulating tape. Thoroughly clean conductors and materials used in a splice, tap, or connection before makeup to ensure good electrical and mechanical connections. Provide conductor identification with each enclosure where a tap, splice, or termination is made and at equipment terminal of each conductor. Ensure that terminal and conductor identification match that shown on approved shop drawings. Hand lettering or marking is not acceptable. Properly identify control-circuit terminals of equipment by color-coded insulated conductors, number-coded plastic self-sticking printed markers, or permanently attached metal-foil markers. Cable fittings and insulating tape - UL labeled.
- e. Where several feeders pass through a common pullbox, tag feeders to clearly indicate electrical characteristics, circuit number, and panel designation. Orient tags so as to be easily read.

3.3 BOXES AND FITTINGS

- a. Install junction, pull, and outlet boxes where required and where indicated.
- b. Furnish and install pullboxes where necessary in conduit system to facilitate conductor installation. For conduit runs longer than 100 ft or with more than three right-angle bends, install a pullbox at a convenient intermediate location.
- c. Securely mount boxes and enclosures to building structure, with supporting facilities independent of conduit entering or leaving boxes.
- d. Use bonding jumpers around concentric or eccentric knockouts.
- e. Approximate mounting heights of wall-mounted outlet and switch boxes, measured between bottom of box and finished floor, are as follows, except as otherwise indicated.

LOCATION	MOUNTING HEIGHT, in.
Receptacles in offices	15
Receptacles in corridors	15
Receptacles in shops	42
Receptacles for clocks	96
Switches for light control	42
Thermostats	42

3.4 WIRING DEVICES

- a. Install switches and receptacles so that, when device plates are applied, plates are aligned vertically to within 0.6 in.
- b. Bond ground terminal of each flush-mounted receptacle to outlet box with an approved green bonding jumper.
- c. Type written directory on light and power panelboards, switchboards, and motor control center.

3.5 LIGHTING FIXTURES

Independently supported from structure, and braced to prevent lateral movement.

3.6 GROUNDING

- a. Drive in ground rods so that top of rod is 6 in. above grade.
- b. Ensure that metallic raceway systems have electrical continuity with equipment individually, and are directly connected to building ground, independently of raceway system, as herein specified. Provide raceways with appropriately sized green grounding conductors.
- c. Connect enclosures for panelboards individually and directly to building ground. Provide grounding conductor connected from building ground to a copper ground-bus terminal strip located in each panelboard.
- d. Ground polarized receptacles, lighting fixtures, and equipment enclosures with an identified (green color) insulated conductor, minimum #12 AWG, connected to branch circuit ground-bus terminal strip. Ground-bus terminal strip in each panelboard enclosure - Isolated and independent of system neutral terminal strip.
- e. Accomplish building and equipment grounding in accordance with NFPA 70.

3.7 IDENTIFICATION AND LABELING

- a. Provide an identification plate marked "DANGER: 480 VOLTS" clearly visible on the outside of 480 V enclosures. Use white lettering on a red laminated plastic placard.
- b. Provide arc flash warning labels reading: "DANGER: ARC FLASH AND SHOCK HAZARD. CAN CAUSE INJURY OR DEATH. APPROPRIATE PPE AND TOOLS REQUIRED WHEN WORKING LIVE". Minimum size is 2-1/2 inches by 5 inches.
- c. Label device plates and cover plates for receptacles and switches, indicating supply circuit and panel numbers. Label - use Dymo self adhesive plastic or equivalent.
- d. Label disconnect switches and hard-wired equipment indicating supply circuit and panel numbers, and the load supplied. Label - use Dymo self adhesive plastic or equivalent.
- e. Label panel board circuits with an accurate schedule of circuits on the inside of the panel door. Schedules shall be typed with a font size of 12.

3.8 FIELD TESTS

a. Wiring System Tests

1. After completion of installation and splicing, and before energizing conductors, conduct wire and cable continuity and insulation tests as specified herein and in accordance with the latest NETA standards.
2. Completely isolate wire and cable in each voltage classification from extraneous electrical connections at cable terminations and joints. Use substation and switchboard feeder breakers, disconnects in combination motor starters, circuit breakers in panel boards, and other disconnecting devices to isolate circuits under test.
3. Conduct insulation tests on circuits rated 480 V and less using a 500 V or 1 kV insulation-resistance test set. Minimum resistance between phase conductors, and between phase conductors and ground: 25 Mohms.
4. Conduct phase-rotation tests on three-phase circuits using a phase-rotation indicating instrument. Ensure that three-phase motors are rotating in proper direction, and that phase-sensitive equipment is phased properly for correct operation.

b. Grounding System Tests

1. Test grounding systems for ground resistance.
2. Perform ground resistance tests during dry weather and not sooner than 48 hours after rainfall. Conduct tests using ratio method that measures ratio of resistance to earth of an auxiliary test electrode to series resistance of electrode under test and a second auxiliary electrode. Perform measurements in accordance with [IEEE 81](#), by the ratio ohmmeter and as specified herein.
3. Place auxiliary grounding electrodes in accordance with instrument manufacturer's recommendations, but minimum 50 ft apart in accordance with [IEEE 81](#).

c. Records

1. Record test readings, including method of testing and environmental conditions of test; submit to COTR no later than 14 calendar days after the test.
2. Submit a certified record of ground-resistance tests on each driven ground-rod assembly and other grounding electrode, including number of rods driven and their depths at each location, to meet required resistance-to-ground measurements. Include a statement describing condition of soil at time of measurement. Identify location of each ground-rod assembly and other grounding electrodes by letter in alphabetical order, and key to record of ground-resistance tests.
3. Final acceptance depends upon successful performance of wire and cable under test. Do not energize any conductor until

installation field tests are complete and approved.

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SECTION 23 07 00

THERMAL INSULATION FOR MECHANICAL SYSTEMS
04/08

PART 1 GENERAL

1.1 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. At the discretion of the Government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP (2007; Supplement 2008; Errata 2009)
Energy Standard for Buildings Except
Low-Rise Residential Buildings, I-P Edition

ASHRAE 90.2 (2007) Energy Efficient Design of Low-Rise
Residential Buildings

ASTM INTERNATIONAL (ASTM)

ASTM A 167 (1999; R 2009) Standard Specification for
Stainless and Heat-Resisting
Chromium-Nickel Steel Plate, Sheet, and
Strip

ASTM A 240/A 240M (2009a) Standard Specification for
Chromium and Chromium-Nickel Stainless
Steel Plate, Sheet, and Strip for Pressure
Vessels and for General Applications

ASTM A 580/A 580M (2008) Standard Specification for
Stainless Steel Wire

ASTM B 209 (2007) Standard Specification for Aluminum
and Aluminum-Alloy Sheet and Plate

ASTM B 209M (2007) Standard Specification for Aluminum
and Aluminum-Alloy Sheet and Plate (Metric)

ASTM C 1126 (2004) Standard Specification for Faced or
Unfaced Rigid Cellular Phenolic Thermal
Insulation

ASTM C 1136 (2008) Standard Specification for
Flexible, Low Permeance Vapor Retarders
for Thermal Insulation

ASTM C 1290 (2006e1) Standard Specification for

	Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts
ASTM C 1427	(2007) Specification for Preformed Flexible Cellular Polyolefin Thermal Insulation in Sheet and Tubular Form
ASTM C 195	(2000) Standard Specification for Mineral Fiber Thermal Insulating Cement
ASTM C 449	(2007) Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C 533	(2009) Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 534/C 534M	(2008) Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 547	(2008e1) Standard Specification for Mineral Fiber Pipe Insulation
ASTM C 552	(2007) Standard Specification for Cellular Glass Thermal Insulation
ASTM C 553	(2008) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 591	(2008a) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 592	(2008a) Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type)
ASTM C 610	(2009) Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation
ASTM C 612	(2009) Mineral Fiber Block and Board Thermal Insulation
ASTM C 647	(2008) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM C 665	(2006) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 795	(2008) Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel

ASTM C 916	(1985; R 2007) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM C 920	(2008) Standard Specification for Elastomeric Joint Sealants
ASTM C 921	(2009) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM D 774/D 774M	(1997; R 2007) Bursting Strength of Paper
ASTM D 882	(2009) Tensile Properties of Thin Plastic Sheeting
ASTM E 2231	(2007a) Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics
ASTM E 84	(2009c) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E 96/E 96M	(2005) Standard Test Methods for Water Vapor Transmission of Materials
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-69	(2003; R 2004) Standard for Pipe Hangers and Supports - Selection and Application
MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)	
MICA Insulation Stds	(1999) National Commercial & Industrial Insulation Standards
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 255	(2005; Errata 2006) Standard Method of Test of Surface Burning Characteristics of Building Materials
NFPA 96	(2007) Ventilation Control and Fire Protection of Commercial Cooking Operations
U.S. DEPARTMENT OF DEFENSE (DOD)	
MIL-A-3316	(Rev C; Am 2) Adhesives, Fire-Resistant, Thermal Insulation
UNDERWRITERS LABORATORIES (UL)	
UL 723	(2008) Standard for Test for Surface Burning Characteristics of Building Materials

1.2 SYSTEM DESCRIPTION

1.2.1 General

Provide field-applied insulation and accessories on mechanical systems as specified herein; factory-applied insulation is specified under the equipment to be insulated.

1.2.2 Surface Burning Characteristics

Unless otherwise specified, insulation shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with [ASTM E 84](#). Flame spread, and smoke developed indexes, shall be determined by [ASTM E 84](#), [NFPA 255](#) or [UL 723](#). Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Test specimens shall be prepared and mounted according to [ASTM E 2231](#). Insulation materials located exterior to the building perimeter are not required to be fire rated.

1.2.3 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the materials meets all other requirements of this section. The minimum recycled material content of the following insulation are:

- Rock Wool - 75 percent slag of weight
- Fiberglass - 20-25 percent glass cullet by weight
- Rigid Foam - 9 percent recovered material

1.3 SUBMITTALS

Government approval is required for submittals. Submit the following in accordance with Section [01300 SUBMITTALS](#):

Submit the three SD types, SD-02 Shop Drawings, SD-03 Product Data, and SD-08 Manufacturer's Instructions at the same time for each system.

[SD-02 Shop Drawings](#)

[MICA Plates](#)

[Pipe Insulation Systems](#) and Associated Accessories
[Equipment Insulation Systems](#) and Associated Accessories

A booklet containing completed [MICA Insulation Stds](#) plates detailing each insulating system for each pipe, duct, or equipment insulating system, after approval of materials and prior to applying insulation.

- a. The MICA plates shall detail the materials to be installed and the specific insulation application. Submit all MICA plates required showing the entire insulating system, including plates required to show insulation penetrations, vessel bottom and top heads, legs, and skirt insulation as applicable. The MICA plates shall present all variations of insulation systems including locations, materials, vaporproofing, jackets and insulation accessories.
- b. If the Contractor elects to submit detailed drawings instead of edited MICA Plates, the detail drawings shall be technically equivalent to the edited MICA Plate submittal.

SD-03 Product Data

Pipe Insulation Systems Equipment Insulation Systems

A complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories including adhesives, sealants and jackets for each mechanical system requiring insulation shall be included. The product data must be copywrited, have an identifying or publication number, and shall have been published prior to the issuance date of this solicitation. Materials furnished under this section of the specification shall be submitted together in a booklet and in conjunction with the MICA plates booklet (SD-02). Annotate the product data to indicate which MICA plate is applicable.

SD-08 Manufacturer's Instructions

Pipe Insulation Systems Equipment Insulation Systems

Submit a booklet containing manufacturer's published installation instructions for the insulation systems in coordination with the submitted MICA Insulation Stds plates booklet. Annotate their installation instructions to indicate which product data and which MICA plate are applicable. The instructions must be copywrited, have an identifying or publication number, and shall have been published prior to the issuance date of this solicitation.

1.4 QUALITY ASSURANCE

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

1.5 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants. The Contracting Officer may reject insulation material and supplies that become dirty, dusty, wet, or contaminated by some other means. Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material. Insulation packages and containers shall be asbestos free.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Provide insulation systems in accordance with the approved MICA National Insulation Standards plates as supplemented by this

specification. Provide field-applied insulation for piping systems which are located with, and adjacent to buildings.

2.2 MATERIALS

Provide insulation that meets or exceed the requirements of [ASHRAE 90.1 - IP](#). Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling. Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either wet or dry state. Materials shall be asbestos free and conform to the following:

2.2.1 Adhesives

2.2.1.1 Mineral Fiber Insulation Cement

Cement shall be in accordance with [ASTM C 195](#).

2.2.1.2 Lagging Adhesive

Lagging is the material used for [thermal insulation](#), especially around a cylindrical object. This may include the insulation as well as the cloth/material covering the insulation. Lagging adhesives shall be nonflammable and fire-resistant and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with [ASTM E 84](#). Adhesive shall be [MIL-A-3316](#), Class 1, pigmented white and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bonding glass tape to joints of fibrous glass board; for bonding lagging cloth to thermal insulation; or Class 2 for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations for pipe and duct insulation.

2.2.2 Contact Adhesive

Adhesives may be any of, but not limited to, the neoprene based, rubber based, or elastomeric type that have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with [ASTM E 84](#). The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not emit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to [212 degrees F](#). The dried adhesive shall be nonflammable and fire resistant. Natural cross-ventilation, local (mechanical) pickup, and/or general area (mechanical) ventilation shall be used to prevent an accumulation of solvent vapors, keeping in mind the ventilation pattern must remove any heavier-than-air solvent vapors from lower levels of the workspaces. Gloves and spectacle-type safety glasses are recommended in accordance with safe installation practices.

2.2.3 Caulking

[ASTM C 920](#), Type S, Grade NS, Class 25, Use A.

2.2.4 Corner Angles

Nominal 0.016 inch aluminum 1 by 1 inch with factory applied kraft backing. Aluminum shall be ASTM B 209, Alloy 3003, 3105, or 5005.

2.2.5 Finishing Cement

ASTM C 449: Mineral fiber hydraulic-setting thermal insulating and finishing cement. All cements that may come in contact with Austenitic stainless steel must comply with ASTM C 795.

2.2.6 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth, with 20X20 maximum mesh size, and glass tape shall have maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84. Tape shall be 4 inch wide rolls. Class 3 tape shall be 4.5 ounces/square yard.

2.2.7 Staples

Outward clinching type ASTM A 167, Type 304 or 316 stainless steel.

2.2.8 Jackets

2.2.8.1 Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.016 inch nominal thickness; ASTM B 209, Temper H14, Temper H16, Alloy 3003, 5005, or 3105. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.015 inch thick, 1/2 inch wide for pipe under 12 inch diameter and 3/4 inch wide for pipe over 12 inch and larger diameter. Aluminum jacket circumferential seam bands shall be 2 by 0.016 inch aluminum matching jacket material. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburgh or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

2.2.8.2 Polyvinyl Chloride (PVC) Jackets

Polyvinyl chloride (PVC) jacket and fitting covers shall have high impact strength, UV resistant rating or treatment and moderate chemical resistance with minimum thickness 0.030 inch.

2.2.8.3 Vapor Barrier/Weatherproofing Jacket

Vapor barrier/weatherproofing jacket shall be laminated self-adhesive, greater than 3 plys standard grade, silver, white, black and embossed or greater than 8 ply (minimum 2.9 mils adhesive); with 0.0000 permeability when tested in accordance with ASTM E 96/E 96M; heavy duty, white or natural; and UV resistant.

2.2.9 Vapor Retarder Not Required

ASTM C 921, Type II, Class D, minimum puncture resistance 50 Beach units on all surfaces where Type IV, maximum moisture vapor transmission 0.10, a minimum puncture resistance of 25 Beach units is acceptable. Jacket shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84.

2.2.10 Wire

Soft annealed [ASTM A 580/A 580M](#) Type 302, 304 or 316 stainless steel, 16 or 18 gauge.

2.2.11 Insulation Bands

Insulation bands shall be $1/2$ inch wide; 26 gauge stainless steel.

2.2.12 Sealants

Sealants shall be chosen from the butyl polymer type, the styrene-butadiene rubber type, or the butyl type of sealants. Sealants shall have a maximum moisture vapor transmission of 0.02 perms, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with [ASTM E 84](#).

2.3 PIPE INSULATION SYSTEMS

Insulation materials shall conform to Table 1. Insulation thickness shall be as listed in Table 2 and meet or exceed the requirements of [ASHRAE 90.1 - IP](#). Comply with EPA requirements. Pipe insulation materials shall be limited to those listed herein and shall meet the following requirements:

2.3.1 Aboveground Hot Pipeline (Above 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications shall meet the following requirements. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

- a. Mineral Fiber: [ASTM C 547](#), Types I, II or III, supply the insulation with manufacturer's recommended factory-applied jacket.
- b. Calcium Silicate: [ASTM C 533](#), Type I indoor only, or outdoors above 250 degrees F pipe temperature. Supply insulation with the manufacturer's recommended factory-applied jacket/vapor barrier.
- c. Cellular Glass: [ASTM C 552](#), Type II and Type III. Supply the insulation with manufacturer's recommended factory-applied jacket.
- d. Polyisocyanurate Insulation: [ASTM C 591](#), Type 1, to 300 degrees F service. Supply the insulation with manufacturer's recommended factory applied jacket/vapor barrier.

2.4 EQUIPMENT INSULATION SYSTEMS

Insulate equipment and accessories as specified in Tables 4 and 5. Increase the specified insulation thickness for equipment where necessary to equal the thickness of angles or other structural members to make a smooth, exterior surface.

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

Insulation shall only be applied to unheated and uncooled piping and equipment. The insulation shall not pull apart after a one hour period;

any insulation found to pull apart after one hour, shall be replaced.

3.1.1 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with **MICA Insulation Stds** plates except where modified herein or on the drawings.

3.1.2 Painting and Finishing

Paint or color code non-metallic jackets or lagging specified in Section **15000 GENERAL MECHANICAL**.

3.1.3 Welding

No welding shall be done on piping, duct or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

3.1.4 Pipes/Equipment which Require Insulation

Insulation is required on all pipes or equipment, except for omitted items, as specified.

3.2 PIPE INSULATION SYSTEMS INSTALLATION

Install pipe insulation systems in accordance with the approved **MICA Insulation Stds** plates as supplemented by the manufacturer's published installation instructions.

3.2.1 Pipe Insulation

3.2.1.1 General

Pipe insulation shall be installed on aboveground hot pipeline systems as specified below to form a continuous thermal retarder/barrier, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

- a. ASME stamps.
- b. Cleanouts or handholes.

3.2.1.2 Pipes Passing Through Walls, Roofs, and Floors

- a. Pipe insulation shall be continuous through the sleeve, unless otherwise noted.
- b. An aluminum jacket or vapor barrier/weatherproofing - self adhesive jacket (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, greater than 3 ply standard grade, silver, white, black and embossed with factory applied moisture retarder shall be provided over the insulation wherever penetrations require sealing.

3.2.1.3 Pipes Passing Through Hangers

- a. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 2 inches and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 2 inches shall be installed, or factory insulated hangers (designed with a load bearing core) can be used.
- b. Horizontal pipes larger than 2 inches at 60 degrees F and above shall be supported on hangers in accordance with MSS SP-69.
- c. Vertical pipes shall be supported with either Type 8 or Type 42 riser clamps with the addition of two Type 40 protection shields in accordance with MSS SP-69 covering the 360-degree arc of the insulation. An insulation insert of cellular glass or calcium silicate shall be installed between each shield and the pipe. The insert shall cover the 360-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. The insulation jacket shall be continuous over the insulation insert. The vertical weight of the pipe shall be supported with hangers located in a horizontal section of the pipe. When the pipe riser is longer than 30 feet, the weight of the pipe shall be additionally supported with hangers in the vertical run of the pipe that are directly clamped to the pipe, penetrating the pipe insulation. These hangers shall be insulated and the insulation jacket sealed as indicated herein for anchors in a similar service.
- d. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe jacket 1-1/2 inches, and shall be sealed as required for the pipe jacket.

3.2.1.4 Pipe Insulation Material and Thickness

TABLE 1
Insulation Material For Piping (°F)

Service	Material	Spec.	Type	Class	Vapor Retarder/ Vapor Barrier Required
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Hot Water, Steam (Max 250°F)	Mineral Fiber	ASTM C 547	I	1	No
	Calcium Silicate	ASTM C 533	I		No
	Cellular Glass	ASTM C 552	II	2	No
	Perlite	ASTM C 610			No
	Polyisocyanurate	ASTM C 591	I		No

TABLE 2
Piping Insulation Thickness (inch and °F)

Service	Material	Tube And Pipe Size (Inches)				
		<1	1- <1.5	1.5- <4	4- <8	>or = to 8
Hot Water, Steam (Max. 250°F)	Mineral Fiber	1.5	1.5	2	2	2
	Calcium Silicate	2.5	2.5	3	3	3
	Cellular Glass	2	2.5	3	3	3
	Perlite	2.5	2.5	3	3	3
	Polyisocyanurate	1	1	1.5	1.5	1.5

3.2.2 Aboveground Hot Pipelines

3.2.2.1 General Requirements

Unless otherwise noted on the drawings, all hot pipe lines above 60 degrees F, except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted, shall be insulated in accordance with Table 2. This includes but is not limited to the following:

- a. Steam.
- b. Condensate.
- c. Hot water auxiliary heating.
- d. Boiler feedwater and return.
- e. Feedwater tank drain where exposed to personnel.

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type I jacket or field applied aluminum where required or seal welded PVC.

3.2.2.2 Insulation for Fittings and Accessories

- a. General. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant. Insulation shall be marked showing the location of unions, strainers, check valves and other components that would otherwise be hidden from view by the insulation.
- b. Precut or Preformed. Precut or preformed insulation shall be placed around all fittings and accessories. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity.

- c. Rigid Preformed. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches minimum or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow".

3.2.3 Piping Exposed to Weather

Piping exposed to weather shall be insulated and jacketed as specified for the applicable service inside the building. After this procedure, a laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability (greater than 3 ply, standard grade, silver, white, black and embossed aluminum jacket shall be applied.

3.2.3.1 Aluminum Jacket

The jacket for hot piping may be factory applied. The jacket shall overlap not less than 2 inches at longitudinal and circumferential joints and shall be secured with bands at not more than 12 inch centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping above 60 degrees F shall be sealed with a moisture retarder.

3.2.3.2 Insulation for Fittings

Flanges, unions, valves, fittings, and accessories shall be insulated and finished as specified for the applicable service. Two coats of breather emulsion type weatherproof mastic (impermeable to water, permeable to air) recommended by the insulation manufacturer shall be applied with glass tape embedded between coats. Tape overlaps shall be not less than 1 inch and the adjoining aluminum jacket not less than 2 inches. Factory preformed aluminum jackets may be used in lieu of the above.

3.3 EQUIPMENT INSULATION SYSTEMS INSTALLATION

Install equipment insulation systems in accordance with the approved MICA Insulation Stds plates as supplemented by the manufacturer's published installation instructions.

3.3.1 General

Removable insulation sections shall be provided to cover parts of equipment that must be opened periodically for maintenance including vessel covers, fasteners, flanges and accessories. Equipment insulation shall be omitted on the following:

- a. Hand-holes.
- b. Manholes.
- c. Cleanouts.
- d. ASME stamps.
- e. Manufacturer's nameplates.

3.3.2 Insulation for Hot Equipment

Insulation shall be furnished on equipment handling media above 60 degrees F including the following:

- a. Heat exchangers.
- b. Feed-water heaters and tank.

3.3.2.1 Insulation

Insulation shall be suitable for the temperature encountered. Shell and tube-type heat exchangers shall be insulated for the temperature of the shell medium.

Insulation thickness for hot equipment shall be determined using Table 6:

Legend

- RMF: Rigid Mineral Fiber
- FMF: Flexible Mineral Fiber
- CS: Calcium Silicate
- PL: Perlite
- CG: Cellular Glass
- PC: Polyisocyanurate Foam

TABLE 6
Insulation Thickness for Hot Equipment (Inches and °F)

Equipment handling steam or media to indicated pressure or temperature limit:	Material	Thickness
15 psig	RMF	2.0 inches
or	CS/PL	4.0 inches
250F	CG	3.0 inches
	PC	1.0 inches

3.3.2.2 Deaerator Heater/Feedwater Tank, Vent Condenser

- a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.
- b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not greater than 12 inch centers except flexible elastomeric cellular which shall be adhered. Insulation corners shall be protected under wires and bands with suitable corner angles.
- c. Insulation on heads of heat exchangers shall be removable. The removable section joint shall be fabricated using a male-female shiplap type joint. Entire surface of the removable section shall be finished as specified.
- d. Exposed insulation corners shall be protected with corner angles.
- e. Upon completion of installation of insulation, penetrations shall be

caulked. Two coats of adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be $1/16$ inch. Caulking shall be applied to parting line between equipment and removable section insulation.

3.3.3 Equipment Exposed to Weather

3.3.3.1 Installation

Equipment exposed to weather shall be insulated and finished as specified for the applicable service for exposed duct inside the building. After the above is accomplished, the insulation shall then be further finished as detailed in the following subparagraphs.

3.3.3.2 Round Equipment

Laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - Less than 0.0000 permeability, (greater than 3 ply, standard grade, silver, white, black and embossed or greater than 8 ply, heavy duty, white and natural) membrane shall be applied overlapping material by 3 inches no bands or caulking needed - see manufacturer's recommended installation instructions. Aluminum jacket with factory applied moisture retarder shall be applied with the joints lapped out less than 3 inches and secured with bands located at circumferential laps and at not more than 12 inch intervals throughout. Horizontal joints shall lap down to shed water and located at 4 or 8 o'clock position. Joints shall be sealed with caulking to prevent moisture penetration. Where jacketing abuts an un-insulated surface, joints shall be sealed with caulking.

3.3.3.3 Fittings

Fittings and other irregular shapes shall be finished as specified for rectangular equipment.

3.3.3.4 Rectangular Equipment

Two coats of weather barrier mastic reinforced with fabric or mesh for outdoor application shall be applied to the entire surface. Each coat of weatherproof mastic shall be $1/16$ inch minimum thickness. The exterior shall be a metal jacketing applied for mechanical abuse and weather protection, and secured with screws.

-- End of Section --

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DEAERATOR HEATER
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PART 1 GENERAL

1.1 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 ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)

AASHTO M 118 (1979) Coal-Tar Bitumen Used in Roofing,
Damp-Proofing, and Waterproofing

AMERICAN BOILER MANUFACTURERS ASSOCIATION (ABMA)

ABMA Boiler 103 (2001) Selected Codes and Standards of the
Boiler Industry

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 350 (2005) Load and Resistance Factor Design
(LRFD) Specification for Structural Steel
Buildings

AISC 360 (2005) Specification for Structural Steel
Buildings, with Commentary

AMERICAN LADDER INSTITUTE (ALI/LADDER)

ALI/LADDER A14.3 (2002) Standard for Fixed Ladders and
Safety Requirements

AMERICAN PETROLEUM INSTITUTE (API)

API Std 607 (2005; Errata 2008) Fire Test for
Soft-Seated Quarter-Turn Valves

API Std 650 (2007; Errata 2008) Welded Steel Tanks for
Oil Storage

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511 (2007) Standard for Reduced-Pressure
Principle Backflow Prevention Assembly

AWWA C651 (2005; Errata 2005) Standard for
Disinfecting Water Mains

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2008; Errata 2009) Structural Welding

Code - Steel

AWS D1.3/D1.3M

(2008; Errata 2008) Structural Welding
Code - Sheet Steel

ASME INTERNATIONAL (ASME)

ASME A13.1

(2007) Scheme for the Identification of
Piping Systems

ASME B16.11

(2009) Forged Fittings, Socket-Welding and
Threaded

ASME B16.18

(2001; R 2005) Cast Copper Alloy Solder
Joint Pressure Fittings

ASME B16.21

(2005) Nonmetallic Flat Gaskets for Pipe
Flanges

ASME B16.22

(2001; R 2005) Standard for Wrought Copper
and Copper Alloy Solder Joint Pressure
Fittings

ASME B16.26

(2006) Standard for Cast Copper Alloy
Fittings for Flared Copper Tubes

ASME B16.3

(2006) Malleable Iron Threaded Fittings,
Classes 150 and 300

ASME B16.34

(2009) Valves - Flanged, Threaded and
Welding End

ASME B16.39

(2009) Standard for Malleable Iron
Threaded Pipe Unions; Classes 150, 250,
and 300

ASME B16.5

(2009) Standard for Pipe Flanges and
Flanged Fittings: NPS 1/2 Through NPS 24

ASME B16.9

(2007) Standard for Factory-Made Wrought
Steel Buttwelding Fittings

ASME B31.3

(2008) Process Piping

ASME B40.100

(2005) Pressure Gauges and Gauge
Attachments

ASME BPVC SEC I

(2007; Addenda 2008) Boiler and Pressure
Vessel Code; Section I, Power Boilers

ASME BPVC SEC II-C

(2007; Addenda 2008) Boiler and Pressure
Vessel Code; Section II, Materials, Part C
- Specifications for Welding Rods,
Electrodes and Filler Metals

ASME BPVC SEC VII

(2007; Addenda 2008) Boiler and Pressure
Vessel Code; Section VII, Recommended
Guidelines for the Care of Power Boilers

ASME BPVC SEC VIII D1	(2007; Addenda 2008) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage
ASME PTC 4	(2008) Fired Steam Generators
ASTM INTERNATIONAL (ASTM)	
ASTM A 106/A 106M	(2008) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 193/A 193M	(2009) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194/A 194M	(2009) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A 242/A 242M	(2004; R 2009) Standard Specification for High-Strength Low-Alloy Structural Steel
ASTM A 312/A 312M	(2009) Standard Specification for Seamless, Welded, and Heavily Worked Austenitic Stainless Steel Pipes
ASTM A 48/A 48M	(2003; R 2008) Standard Specification for Gray Iron Castings
ASTM A 53/A 53M	(2007) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM B 111/B 111M	(2009) Standard Specification for Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock
ASTM B 88	(2003) Standard Specification for Seamless Copper Water Tube
ASTM B 88M	(2005) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM D 1047	(2007) Poly(Vinyl Chloride) Jacket for Wire and Cable
ASTM D 1220	(1965; R 1990) Measurement and Calibration of Upright Cylindrical Tanks
ASTM D 396	(2009) Standard Specification for Fuel Oils
ASTM D 5864	(2005) Standard Test Method for Determining Aerobic Aquatic Biodegradation of Lubricants or Their Components
ASTM D 6081	(1998; R 2004) Aquatic Toxicity Testing of Lubricants: Sample Preparation and Results

Interpretation

ASTM E 2129	(2005) Standard Practice for Data Collection for Sustainability Assessment of Building Products
ASTM F 1007	(1986; R 2007) Pipeline Expansion Joints of the Packed Slip Type for Marine Application
ASTM F 1120	(1987; R 2004) Standard Specification for Circular Metallic Bellows Type Expansion Joints for Piping Applications
ASTM F 1508	(1996; R 2004) Angle Style, Pressure Relief Valves for Steam, Gas, and Liquid Services
FM GLOBAL (FM)	
FM DS 12-17	(2001) Watertube Boilers
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-58	(2002) Standard for Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(2003; R 2004) Standard for Pipe Hangers and Supports - Selection and Application
MSS SP-70	(2006) Standard for Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-80	(2008) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(2002) Standard for Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS (NBBPVI)	
NBBPVI NB-27	(1991) National Board Rules and Recommendations for the Design and Construction of Boiler Blowoff Systems
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)	
NEMA MG 1	(2007; Errata 2008) Standard for Motors and Generators
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 54	(2008) National Fuel Gas Code
NFPA 85	(2007) Boiler and Combustion Systems Hazards Code

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 10 (2007) Near-White Blast Cleaning

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 1110-2-1424 (1999; Change 1) Lubricants and Hydraulic Fluids

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101 (Rev B) Color Code for Pipelines & for Compressed Gas Cylinders

MIL-T-19646 (Rev A) Thermometer, Gas Actuated, Remote Reading

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS A-A-50494 (Basic) Exhaust Head, Steam

FS A-A-50555 (Basic) Pumping Units, Sewage, Duplex, Centrifugal, Automatic Wet-Pit Type

FS A-A-50558 (Basic) Valves, Pressure Regulating, Steam

FS A-A-50562 (Basic) Pump Units, Centrifugal, Water, Horizontal; General Service and Boiler-Feed: Electric-Motor- or Steam-Turbine-Driven

FS A-A-59222 (Basic) Fans, Centrifugal, Draft, Forced and Induced

FS A-A-59224 (Basic; Notice 1) Meters, Fluid Quantity Volumetric

FS A-A-60001 (Basic) Traps, Steam

FS F-B-2902 (Basic) Boilers, Steam Watertube (Bent Tube, Multi-Drum and Cross Drum) Packaged Type (10,000,000 to 125,000,000 BTU/HR Thermal Output Capacity)

FS F-B-2910 (Basic) Burners, Single Oil, Gas, and Gas-Oil Combination for Packaged Boilers (320,001 to 125,000,000 BTU/HR Thermal Output Capacity)

FS F-F-351 (Rev F) Filters and Filter Elements, Fluid Pressure: Lubricating Oil, Bypass and Full Flow

FS W-H-2904 (Basic) Heaters, Fluid, Deaerating (For Water Only) 1,000 to 1,600,000 Pounds Per Hour Capacity

FS WW-S-2739 (Basic) Strainers, Sediment: Pipeline, Water, Air, Gas, Oil, or Steam

FS XX-C-2816 (Basic) Compressor, Air, Reciprocating or Rotary, Electric Motor Driven, Stationary, 10 HP and Larger

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

29 CFR 1910-SUBPART D Walking - Working Surfaces

29 CFR 1910-SUBPART Q Welding, Cutting, and Brazing

U.S. NAVAL FACILITIES ENGINEERING COMMAND (NAVFAC)

NAVFAC MO 324 (1992) Inspection and Certification of Boilers and Unfired Pressure Vessels

UNDERWRITERS LABORATORIES (UL)

UL 296 (2003; Rev thru Aug 2009) Oil Burners

UL 726 (1995; Rev thru Aug 2009) Oil-Fired Boiler Assemblies

UL 795 (2006; Rev thru Aug 2009) Commercial-Industrial Gas Heating Equipment

WATER QUALITY ASSOCIATION (WQA)

WQA S-100 (1995) Household Commercial and Portable Exchange Water Softeners and Equipment Validation Standard

1.2 RELATED REQUIREMENTS

The following UFGS sections apply to this section, with the additions and modifications specified herein:

- a. 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS
- b. 40 17 26.00 20 WELDING PRESSURE PIPING

1.3 SYSTEM DESCRIPTION

1.3.1 Design Requirements

1.3.1.1 Existing Boiler Design and Service Conditions

- a. Design pressure: 550 psig
- b. Maximum Operating pressure: 500 psig
- c. Steam temperature: 470 degrees F
- d. Feedwater temperature: 230 degrees F
- e. Site elevation: 39 feet
- f. Ambient air temperature:

Minimum: 34 degrees F

Maximum: 89 degrees F

g. Maximum continuous output (steam): 250,000 lb/hr

h. Boiler efficiency: 85 percent

1.3.1.2 Deaerating Heater

a. Performance: Refer to equipment schedule on drawings for requirements.

1.3.2 Detail Drawings

1.3.2.1 Boiler Room Auxiliary Equipment

Drawings shall show equipment arrangements, and piping diagrams. Include descriptive information for each item shown. Submit drawings showing the following:

a. Deaerator

1.3.2.2 Piping and Specialty Items

Drawings may be manufacturer's standard size. Submit drawings showing the following:

a. Details of special valves and fittings

b. Feedwater regulator details and schematics

c. Details and schematics of feedwater automatic recirculation

1.3.3 Design Data

1.3.3.1 Engineering Calculations

Furnish the following calculations from the manufacturer:

a. Deaerating Heater

1. Heating and deaerating capacity

2. Stresses due to various loading conditions including wind and seismic loads.

3. Weight and center of gravity

4. Allowable nozzle loads

1.4 SUBMITTALS

Government approval is required for submittals. The following shall be submitted in accordance with Section 01300 SUBMITTALS:

Submittals required by this section require the approval of the Contracting Officer. Shop drawings accompanied with complete manufacturer's descriptive information shall be submitted for approval as specified in Section 15050 BASIC MECHANICAL MATERIALS AND METHODS. Drawing size shall be

34 by 22 inches.

SD-02 Shop Drawings

Deaerating heater

Piping and specialty items

SD-03 Product Data

Insulation types and installation procedures

Local/Regional Materials

Submit documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site. Indicate relative dollar value of local/regional materials to total dollar value of products included in project.

SD-05 Design Data

Engineering Calculations

SD-06 Test Reports

Submit certified copies of design, production and conformance tests for approval before delivery of the equipment.

Hydrostatic and leak tightness tests

Preliminary operation

General startup requirements

Boilers and auxiliaries tests and inspections

Submit for tests and inspections as specified in paragraph entitled "Field Quality Control." Submit a detailed written record of test conditions, test procedures, field data, and startup and operational performance of entire heating plant to the Contracting Officer before the Contractor's operational and test personnel leave the site.

SD-07 Certificates

ASME Code Manufacturer's Data Reports

System and equipment installation

Submit the required information and experience certificates as specified under paragraph entitled "Experience Requirements," within 30 days after award and prior to commencing work on the site.

SD-10 Operation and Maintenance Data

Include the following supplemental information:

- a. Illustrations, catalog information, shop drawings, and certified drawings of each item of equipment and control components

- b. Tests and test results
- c. Adjustments
- d. List of special tools required
- e. Posted operating instructions
- f. Controls Drawings, Setup and Calibration Data

1.5 QUALITY ASSURANCE

1.5.1 Experience

1.5.1.1 Experience Requirements

The boiler auxiliary equipment installed, within, or as a part of the heating plant, shall be of a proven design; the manufacturer shall be regularly employed in designing, fabricating, erecting, testing and startup of the equipment.

1.5.2 Responsibility of the Deaerating Heater Manufacturer

Contractor shall ensure that the manufacturers of auxiliaries provide equipment compatible with the boiler.

1.5.3 Standard Commercial Product

Equipment shall be manufactured in accordance with the requirements of this specification and shall be the manufacturer's standard commercial product. Additional or higher quality features which are not specifically prohibited by this specification, but which are a part of the manufacturers' standard commercial product, shall be included in the boilers and equipment being provided. A standard commercial product is a product which has been sold or is being currently offered for sale on the commercial market through advertisements or manufacturer's catalogs, or brochures, and represents the latest production model.

1.5.4 Assembly of Components

The equipment shall be factory assembled, or may utilize factory assembled components to the maximum extent to facilitate erection and minimize field labor.

1.5.5 Certificates

1.5.5.1 [Compatibility of Boiler Components and Equipment](#)

Contractor shall submit certifications from the boiler manufacturer stating that boiler components, including auxiliary equipment, are compatible with the boiler. Certificates of compatibility for boiler components and auxiliary equipment not directly produced by the boiler manufacturer may be submitted through the boiler manufacturer.

1.5.5.2 [System and Equipment Installation](#)

Contractor shall submit written certification from each system supplier and each manufacturer of the equipment that the system and equipment installation is in accordance with the system supplier's and equipment

manufacturer's instructions and recommendations, that the unit or system has been run, rotating parts have been dynamically balanced, fluid (including air) flows have been balanced, instrumentation and controls are properly functioning, adjusted and have been calibrated, and the equipment or system is ready for final testing. Certificates shall be submitted before the entire boiler plant may be given an acceptance test.

1.5.5.3 Identical Equipment

Contractor shall submit evidence from the equipment manufacturer to show that substantially identical equipment produced by the manufacturer and of comparable operating parameters (within +/-20 percent) has been successfully installed and operated in not less than two installations under comparable operating conditions for a period of not less than two years.

1.6 DELIVERY, STORAGE, AND HANDLING

Each assembly of components packaged as a unit shall be of a size that can be transported by common carrier without disassembly insofar as shipping clearances are concerned.

1.7 ENVIRONMENTAL REQUIREMENTS

1.7.1 Aquatic Toxicity

Assess potential effects of all lubricants on aquatic organisms in accordance with [ASTM D 6081](#) and submit aquatic toxicity reports. Assess biodegradation in accordance with [ASTM D 5864](#). In accordance with [EM 1110-2-1424](#) Chapter 8, aquatic toxicity shall exceed 1,000 ppm at LL50 and biodegradation shall exceed 60 percent conversion of carbon to carbon dioxide in 28 days.

1.8 SUSTAINABLE DESIGN REQUIREMENTS

1.8.1 Local/Regional Materials

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a 500 mile radius from the project site, if available from a minimum of three sources.

PART 2 PRODUCTS

2.1 MATERIALS

Provide materials free of defects which could adversely affect the performance or maintainability of individual components or of the overall assembly. Materials not specified herein shall be of the same quality used for the intended purpose in commercial practice. Unless specified otherwise herein, equipment, material, and articles incorporated in the work covered by this specification shall be new.

2.1.1 Identical Equipment

Provide physically and mechanically identical equipment of the same classification size or capacity to permit the interchangeability of replacement parts. This requirement includes parts, assemblies, components, and accessories. Parts provided on the same type unit regardless of unit size and identifiable by identical part number shall be

functionally and dimensionally interchangeable. No deviation is acceptable without prior written approval of the Contracting Officer.

2.2 Deaerating Heater

2.2.1 General

Provide a deaerating feedwater heater with storage tank conforming to **FS W-H-2904** and to **ASME BPVC SEC VIII D1**, except as modified below. Tank shall be ASME Code stamped. Provide stainless steel trays. No test model will be required.

Model A - Pressurized operation.

Type I - Tray-type heating and deaerating element.

Grade A - Guaranteed removal from water of dissolved oxygen in excess of **0.0012 in³/gal**, over a ten to one load swing.

2.2.2 Heater Capacity

Provide deaerating heater capable of heating and deaerating makeup water.

2.2.3 Inlet Water Characteristics

Softened makeup water:

Ph: 9

Total hardness (as CaCO₃): <1 ppm

2.2.4 Storage Tank

Horizontal design with steel supports drilled for bolting of approved design. Provide storage tank with not less than a **18 by 24 inch** minimum size manhole and cover and provide heater section with not less than a **18 by 24 inch** minimum size tray access handhole and door.

2.2.5 Vent Condensing Arrangement

Provide the deaerating heater with a vent condenser which shall condense the vented steam when the heater is operating at full capacity with the inlet water mixture at a temperature not exceeding **180 degrees F**.

Construct the vent condenser, when of the direct contact type, with stainless steel baffling.

2.2.6 Materials

Construct trays, tray supports, water distributors, and other parts coming in contact with undeaerated water or air laden steam of 430 stainless steel.

2.2.7 Accessories

Provide deaerating heater with the following accessories:

- a. Pressure Relief Valve: Sized in accordance with **ASME B&PVC SEC VIII DI** and **FS W-H-2904**.
- b. Thermometers: Two, **5 inch** dial thermometers, **50 to 300 degrees F**, with lagging extension type wells for the storage tank and the heater

section. Provide a thermometer similar to above but with range of minus 0 degrees F to plus 250 degrees F for the makeup water connection.

- c. Lifting attachments for the tray section and the storage tank.
- d. Water Gage Glasses: Reflex type with shutoff valve and guards.
- e. Pressure Gages: One 4.5 inch dial compound pressure gage for the heater section with range from 30 inches of mercury (vacuum) to 30 psig.
- f. Float Controllers:
 - 1. Makeup water controller
 - 2. Overflow controller
- g. Overflow Control Valve: With pneumatic controller arranged for local automatic operation.
- h. Storage Tank Gage Glass: Full height, shielded, for storage tank including shutoff valve and drain cocks.
- i. Makeup Water Inlet Control Valve: With pneumatic controller.
- j. Switches: For low water level alarm in the storage tank, high water level alarm, in the storage tank, and low steam pressure alarm. Install switches on a single column with connections valved and unions provided in pipe on each side of each float switch.
- k. Special tools: One set for maintenance.
- l. Furnish pipe, fittings, controls, specialties, bolts, gaskets, drains, and valves, necessary for proper attachment of accessories and trimmings and install.

2.2.8 Connections

Provide necessary connections for condensate, steam, makeup water, removal of vented gases, vacuum breakers, discharge of deaerated water, and instruments and controls.

- a. Provide heater connections as follows:
 - 1. 18 inch steam inlet
 - 2. 8 inch makeup water inlet
 - 3. One relief valves sized as required
 - 4. Vacuum breakers as required
 - 5. Heater drain (sized by design-build contractor)
 - 6. Handholes and manhole with covers
- b. Tank connections shall include:
 - 1. 8 inch drain

2. 3 inch boiler feed recirculation (1 required)
3. One inch sampling
4. One inch chemical feed
5. For sight glass (number of sets as required)
6. For high and low level alarm switches
7. Thermometer well
8. 2 inch spare (capped)
9. Level transmitter and controller (number of sets as required)
10. Downcomer and equalizer as required
11. 10 inch feedwater outlet (1 required) and 6 inch feedwater outlets (2 required)
12. 8 inch overflow outlet with internal water seal
13. 2 inch auxiliary heating water supply

2.2.9 Level Control

Provide an automatic control system to control water level in the storage tank, by modulating valves in makeup water lines.

- a. Controllers: Provide external cage type air operated level controllers for the makeup water lines complete with 1 1/2 inch screwed connections, external cage, and controller. Cage body shall be Class 125 cast iron construction. Internal components including displacer, torque tube, displacer rod, displacer rod driver and bearings shall be 316 stainless steel. Displacer shall be 14 inches long. Controller shall be direct acting with 3 to 15 psig range with proportional band adjustment. Locate controller to maintain an operating level at 2/3-full point of storage tank. Provide level controller with air pressure reducing valve, filter, gages and isolating valves for float cage. Provide unions on each side of float cage.
- b. Air Operated Regulating Valves: Provide air operated control valves for the makeup water lines. Valves shall have Class 125 or Class 150 rating with iron or semi-steel bodies and 316 stainless steel internals. Provide makeup water valve with an air lock mounted on valve diaphragm to hold valve in last position on loss of air. Design valves for the following conditions:

	Makeup Water
Valve size	6 inches
Capacity	500 gpm
Maximum pressure drop at above capacity	10 psig

2.2.10 Gage Glasses

Provide gage glasses to cover the entire range of water level in the storage section. Gage glasses shall not be greater than 24 inches center-to-center. Provide gage glasses complete with ball check shutoff and drain cock valves and safety shield.

2.2.11 Alarms

Provide high and low water level alarms for storage tank as follows:

- a. High Water Level Alarm: Switch with stainless steel float and trim. Locate switch to close circuit when water level rises to one inch below overflow level of storage tank.
- b. Low Water Level Alarm: Switch with stainless steel float and trim. Locate switch to close circuit when water level falls to 55% of storage tank capacity.
- c. Coordination: Coordinate alarms with annunciator panel as indicated.

2.2.12 Valve Actuators

Electrically or pneumatically operated and designed so that valve may be manually operated by removing the drive pins. Actuators shall be operated by push button control. Locate one push button at a position adjacent to the valve. Locate a second push button within the boiler control room. Provide a valve position indicator utilizing indicating lights. A green light shall indicate the valve is fully open and an amber light shall indicate the valve is fully closed. Both lights on shall indicate when the valve is partially open. Provide torque limit controls to protect the valve during opening and closing for electrically operated valves. Actuator electric motor shall be totally enclosed, 120 volts, 1 phase, 60 Hz as specified under paragraph entitled "Motors and Drives" in this section. Provide NEMA 4 control enclosures.

2.3 PIPING

Piping work shall include the provision of piping systems, including valving and specialty items, for the steam plant and related external auxiliary equipment. Piping materials, design, and fabrication shall be in accordance with ASME B31.3 except as modified below or indicated otherwise. The requirements of ASME B31.3 apply to the building steam heating and steam distribution piping designed for 15 psig or lower and hot water heating systems 30 psig or lower. Provide piping materials suitable for the maximum pressure at the maximum temperature at which the equipment must operate. Compute thermal expansion of pipe with operating temperature ranges as indicated on drawings.

2.3.1 Piping Materials (unless noted otherwise on drawings)

- a. Steam Pipe, Boiler Feedwater Pipe, Relief Pipe, Make-Up Water Pipe, Miscellaneous Pipe: Pipe Black, ASTM A 53/A 53M or ASTM A 106/A 106M seamless steel pipe, Grade B. Wall thickness not less than Schedule 40 for pipe sizes less than 12 inches; and 3/8 inch wall for pipe sizes larger than 12 inches.
- b. Instrument Air Pipe: ASTM A312/A 312M austenitic stainless steel.

2.3.2 Chlorinated Polyvinyl Chloride (CPVC)

Chlorinated polyvinyl chloride (CPVC) and other plastic tubing and fittings shall not be used in the steam heating plant, unless otherwise specified.

2.3.3 Fittings (unless noted otherwise on drawings)

Unless otherwise noted on the drawings:

2.3.3.1 Fittings for Steel Pipe

- a. Sizes 1/8 to 2 inches: ASME B16.3 malleable iron, screwed end fittings, for working pressures not greater than 300 psig at temperatures not greater than 450 degrees F or ASME B16.11 forged steel.
- b. Sizes 1/8 to 2 inches: ASME B16.11 steel, socket welded end fittings.
- c. Sizes 1/8 to 2 1/2 inches: ASME B16.9 steel, butt welding fittings.
- d. Sizes 2 1/2 to 24 inches: ASME B16.5 forged steel, flanged fittings.

2.3.3.2 Welded Outlets and Welding Saddles

Make branch connections of 45 and 90 degrees either with ASME B16.9 forged steel welded outlet fittings or welding saddles. Welding outlets and saddles shall not be smaller than two pipe sizes less than the main pipe sizes.

2.3.3.3 Fittings For Copper Tubing

ASME B16.18 cast bronze solder joint or ASME B16.22 wrought copper solder joint. For instrument air, fittings may be ASME B16.26 compression joint type.

2.3.3.4 Unions

- a. Unions For Steel Pipe: ASME B16.11, ASME B16.39 threaded. Unions for zinc coated pipe shall be zinc coated.
- b. Unions For Instrument Air may be compression joint type.

2.3.4 Flanges

ASME B16.5, forged steel, welding type. Except as specified otherwise, pressure and temperature limitations shall be as specified in ASME B16.5 for the proper class and service, and the type face specified.

2.3.5 Valves (unless noted otherwise on drawings)

2.3.5.1 Low Pressure

Unless otherwise noted on the drawings, valves for maximum working pressure of 150 psig saturated steam or 225 psig W.O.G. (Water, Oil, Gas) at 200 degrees F, non-shock service. For working pressures not exceeding 125 psig saturated steam or 200 psig water at 200 degrees F non-shock service, Class 125 may be used in lieu of Class 150 or Class 250.

- a. Valve Sizes 2 Inches and Smaller:

1. Non-Throttling Valves: Gate valves, bronze, wedge disc, rising stem, Class 150, MSS SP-80 or ball valves, bronze, double stem seals, stainless steel ball and shaft, tight shutoff.
2. Globe Valves and Angle Valves: Bronze, Class 150, MSS SP-80.
3. Check Valves: Bronze, Type IV, swing check, Class 150, MSS SP-80.

b. Valve sizes 2 1/2 inches and larger.

1. Gate Valves: Flanged, cast iron, Class 125, MSS SP-70 or steel, Class 150, ASME B16.34. Valves shall have wedge disc, outside screw and yoke (OS&Y), rising stem; valves 8 inches and larger shall have globe valved bypass.
2. Globe Valves and Angle Valves: Flanged, cast iron, Class 125, MSS SP-85 or steel, Class 150, ASME B16.34.
3. Check Valves: Flanged, cast iron, Class 125 or steel, Class 150, swing check, ASME B16.34.

2.3.5.2 Ball Valves

ASME B16.34 double stem seal type for bubble tight shutoff. Seats and seals shall be TFE material. Ball and shaft shall be stainless steel. Provide mechanical stops to prevent cycling valve in wrong direction and self-aligning stem seal.

2.3.5.3 Valve Accessories

ASME B16.34 valve operating mechanisms including chain wheels, gear operators, floor stands, electric motors, air motors and cylinder-type actuating devices. Provide accessories as follows and as indicated.

- a. Provide power operators with remote position indicators as noted on plan.
- b. Provide floor stands and valve extensions on platforms and floors for the following valves: deaerator drain valves.
- c. Provide motorized actuators or chain wheels with chain and guides on valves with handwheel centerline higher than 7 feet above the floor or platform except where specified otherwise. Chains shall extend from valve to within 3 feet above floor. Provide impact chain wheels on steam headers and other locations where valve has a tendency to stick. When a valve is motorized, provide hand operation for emergency.
- d. Provide gear operators on ball valves larger than 3 inches and on gate valves 8 inches and larger.

2.3.5.4 Safety Relief Valves

ASME BPVC SEC VIII D1, ASTM F 1508, Style D or E, with Class 150 inlet flange, with test lever, designed for the intended service.

2.3.6 Bolts and Nuts

- a. Bolts: ASTM A 193/A 193M, Grade B7. Lengths of bolts shall be such that not less than two full threads will extend beyond the

nut with the bolts tightened to required tensions and washers seated.

- b. Nuts: [ASTM A 194/A 194M](#), Grade 8.

2.3.7 Gaskets

Provide spiral wound metal covered non-asbestos gaskets in lieu of compressed sheet non-asbestos. Gaskets shall be as thin as the finish of surfaces will permit. Do not use paper, vegetable fiber, rubber, or rubber inserted gaskets for temperatures greater than [250 degrees F](#). Provide metal or metal jacketed non-asbestos gaskets with small male and female and small tongue-and-groove flanges and flanged fittings; they may be used with steel flanges with lapped, large male and female, large tongue-and-groove, and raised facings. Provide fullface gaskets with flat-faced flanges. Raised face cast iron flanges, lapped steel flanges, and raised faced steel flanges shall have ring gaskets with an outside diameter extending to the inside of the bolt holes. Widths of gaskets for small male and female and for tongue-and-groove joints shall be equal to the widths of the male face and tongue. Gaskets shall have an inside diameter equal to or larger than the port opening. Dimensions for nonmetallic gaskets shall be in accordance with [ASME B16.21](#). Materials for flanged gaskets shall be as listed below for service specified:

- a. Steam: Spiral wound metal composition or copper.
- b. Boiler Feed Water: Metal jacketed non-asbestos, copper or monel.
- c. Cold Water: Red rubber or neoprene rubber.

2.3.8 Pipe Hangers and Supports

[MSS SP-58](#) and [MSS SP-69](#), Type 1 of the adjustable type, except as specified or indicated otherwise. Suspended steam and condensate piping shall have pipe hangers Type 43 with insulation protection saddles Type 39. Provide insulated piping, except steam and condensate piping, with insulation protection shields Type 40. Support rods shall be steel. Rods, hangers and supports shall be zinc plated, cast iron rollers, bases and saddles may be painted with two coats of heat resisting aluminum paint in lieu of zinc plating. Axles for cast iron rollers shall be stainless steel. Size hanger rods with a 150 percent safety factor for a seismic design.

2.3.9 Instrumentation

2.3.9.1 Pressure and Vacuum Gages

Conform to the applicable requirements of [ASME B40.100](#).

2.3.9.2 Indicating Thermometers

[MIL-T-19646](#) dial type. Thermometer shall include a separable immersion well.

2.3.10 Miscellaneous Pipeline Components

2.3.10.1 Strainers

[FS WW-S-2739](#), Style Y for Class 150 with blow off outlet. Provide blow off outlet with pipe nipple and gate valve.

2.3.11 Insulation Types and Installation Procedures

Materials and application shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.3.12 Pipe Sleeves

2.3.12.1 Outside Walls Above and Below Grade

Galvanized steel pipe having an i.d. at least 1/2 inch larger than the o.d. of the pipe passing through it. Provide sufficient sleeve length to extend completely through walls, so that ends of sleeves for walks shall extend 1/2 inch beyond finished surface.

2.3.13 Piping Identification

Conform to MIL-STD-101 and place in clearly visible locations; except that piping in the boiler room shall be painted the primary color of the color code. Labels and tapes conforming to ASME A13.1 shall be used in lieu of band painting or stenciling. Labels shall be outdoor grade acrylic plastic. Markings on the labels shall indicate the direction of flow, flowing media, and media design pressure and temperature. Spacing of identification marking shall not exceed 10 feet. Provide two copies of the complete color and stencil codes used. Frame codes under glass and install where directed.

2.4 MARKING

Identify equipment, valves, switches, motor controllers, and controls or indicating elements by printed, stamped or manufactured identification plates or tags of rigid plastic or non-ferrous material. Lettering for identification plates or tags shall be not less than 3/16 inch high. Nomenclature and identification symbols used on identification plates or tags shall correspond to those used in the maintenance manuals, operating instructions, and schematic diagrams. Rigidly affix identification plates or tags to equipment or devices without impairing functions or, when this is not possible, attach using a non-ferrous wire or chain. In addition to the identification plate or tag, each major component of equipment shall have a nameplate listing the manufacturer's name, model number, and when applicable, electrical rating and other information required by pertinent standards or codes.

2.5 TOOLS

Provide special tools and wrenches required for the installation, maintenance, and operation of the equipment.

2.6 WELDING MATERIALS

Comply with ASME BPVC SEC II-C. Welding equipment, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator using qualified welding procedures.

2.7 SOURCE QUALITY CONTROL

2.7.1 Plant Equipment Tests

Tests specified below shall be conducted at factory prior to delivering equipment to job site.

PART 3 EXECUTION

3.1 INSTALLATION

Install materials and equipment as indicated and in accordance with manufacturer's recommendations.

3.1.1 Equipment Installation

Install equipment in accordance with this specification, and the installation instructions of the manufacturers. Equipment mounted on concrete foundations shall be grouted before installing piping. Install piping in such a manner that it will not impart a stress on equipment. Flanged joints shall not be bolted tight unless they match adequately. Expansion bends shall be adequately extended before installation. Support, grade, anchor, and guide all piping so that there are no low pockets, which could accumulate fluids, along the piping run.

3.1.1.1 Equipment Foundations

Equipment foundations shall be of sufficient size and weight, and proper design to prevent shifting of equipment under operating conditions, or under abnormal conditions which could be imposed upon equipment. Equipment vibration shall be limited within acceptable limits, and isolated. Foundations shall be adequate for soil conditions of the site and shall meet requirements of the equipment manufacturer. Trowel exposed foundation surfaces smooth except when properly roughened surfaces are necessary to receive grout.

3.1.2 Piping

Unless specified otherwise, erection, welding, brazing, testing and inspection of piping shall be in accordance with ASME B31.3 and Section 40 17 26.00 20 WELDING PRESSURE PIPING. Piping shall follow the general arrangement shown. Cut piping accurately to measurements established for the work. Work piping into place without springing or forcing, except where cold-springing is specified. Piping and equipment within buildings shall be entirely out of the way of lighting fixtures and doors, windows, and other openings. Locate overhead piping in buildings in the most inconspicuous positions. Do not bury or conceal piping until it has been inspected, tested, and approved. Where pipe passes through building structure, pipe joints shall not be concealed, but shall be located where they may be readily inspected and building structure shall not be weakened. Avoid interference with other piping, conduit, or equipment. Except where specifically shown otherwise, vertical piping shall run plumb and straight and parallel to walls. Install piping connected to equipment to provide flexibility for vibration. Support and anchor piping so that strain from weight of piping is not imposed on equipment.

3.1.2.1 Fittings

Provide long radius elbows on welded piping to reduce pressure drops. Do

not miter pipe to form elbows, notch straight runs to form full sized tees, or use similar construction. Make branch connections with welding tees, except factory made forged welding branch outlets or nozzles having integral reinforcements conforming to ASME B31.3 may be used.

3.1.2.2 Grading of Pipe Lines

Unless indicated otherwise, install horizontal lines of steam and return piping to grade down in the direction of flow with a pitch of not less than one inch in 30 feet, except in loop mains and main headers where flow may be either direction. Pitch air lines to the source of supply, and make provisions for draining off condensate. Install water lines to drain to a shutoff valve.

3.1.2.3 Anchoring, Guiding, and Supporting Piping

Anchor and support piping in a manner such that expansion and contraction will take place in the direction desired, prevent vibration by use of vibration dampeners, and prevent undue strains on boilers and equipment served. Fabricate hangers used for support of piping of 2 inch nominal pipe size and larger to permit adequate adjustment after erection while still supporting the load. Provide wall brackets where pipes are adjacent to walls or other vertical surfaces which may be used for supports. Provide supports to carry weight of lines and maintain proper alignment. Provide inserts and sleeves for supports in concrete where necessary and place in new construction before pouring concrete. Provide insulated piping with a pipe covering protection saddle at each support. Provide pipe guides and anchors of approved type at points where necessary to keep pipes in accurate alignment, to direct expansion movement, and to prevent buckling and swaying and undue strain. Provide pipe guides for alignment of pipe connected to free unanchored end of each expansion joint. Support pipe rollers in concrete conduits and trenches by extra strong steel pipe with ends inserted in slots provided in concrete walls. Set pipe supports for rollers at correct elevations either by metal shims or by cutting away of concrete and after placing pipe lines in alignment, grout ends of pipe supports and fix in place. Space pipe supports to provide adequate support for pipes. Pipe shall not have pockets formed in the span due to sagging of pipe between supports, caused by weight of pipe, medium in pipe, insulation, valves, and fittings. Spacing for pipe supports for steel pipe shall ensure compliance with ASME B31.3 for specified loadings.

3.1.2.4 Sleeves

Provide pipe sleeves where pipes and tubing pass through walls. Space between pipe, tubing, or insulation and the sleeve shall be not less than 1/4 inch. Hold sleeves securely in proper position and location before and during construction. Sleeves shall be of sufficient length to pass through entire thickness of walls, partitions, and slabs and shall extend 1/2 inch beyond the finished wall. Firmly pack space between pipe or tubing and the sleeve with oakum and caulk on both ends of the sleeve with elastic cement.

3.1.2.5 Flashing for Buildings

Where pipes pass through building roofs and outside walls, provide proper flashing and counter flashing and make tight and waterproof.

3.1.2.6 Outlets for Future Connections

Locate as directed capped or plugged outlets for connections to future

equipment, when not located exactly by the project drawings.

3.1.2.7 Screwed Joints in Piping

Provide teflon tape or suitable pipe joint compound applied to male threads only for making up screwed joints. Piping shall be free from fins and burrs. Ream or file out pipe ends to size of bore, and remove chips.

3.1.2.8 Welds and Welded Joints

Weld joints in piping by the metal-arc or gas welding processes in accordance with [ASME B31.3](#). Number or mark each weld to identify the work done by each welder on welds which stress relieving or radiographic inspection is required.

- a. Recertification: The Contracting Officer reserves the right to require the Contractor to provide re-examination and recertification of welders.
- b. Radiographic testing of circumferential butt welded joints of pipe shall be required, the location of which will be determined by the Contracting Officer; when more than ten percent of the radiographically tested joints show unacceptable defects, radiographically test all joints of this type piping.
- c. Equipment and Protection: Items of equipment for welding shall be so designed and manufactured, and be in such condition as to enable qualified operators to follow procedures and to attain the results specified. Protect welders and gas cutters from the light of the arc and flame by approved goggles, shields, helmets, and gloves. Replace cover glasses in helmets and shields when they become sufficiently marred to impair the operator's vision. Take care to avoid risk of explosion and fire when welding and gas cutting near explosive or flammable materials. Ventilate welding and gas cutting operations in accordance with paragraph [29 CFR 1910-SUBPART Q](#).
- d. Surface Conditions: Do not weld when atmospheric temperature is less than [zero degrees F](#), when surfaces are wet, when rain or snow is falling or moisture is condensing on surfaces to be welded, nor during periods of high wind, unless the welder and work are protected properly. At temperatures between [32 degrees F](#) and [0 degrees F](#) heat with a torch the surface for an area within [3 inches](#) of the joint to be welded to a temperature warm to the hand before welding. Free surfaces to be welded from loose scale, slag, rust, paint, oil, and other foreign material. Joint surfaces shall be smooth, uniform and free from fins, tears, and other defects which might affect proper welding. Remove slag from flame-cut edges to be welded by grinding, but temper color need not be removed. Thoroughly clean each layer of weld metal by wire brushing prior to inspection or deposition of additional weld metal.

3.1.2.9 Cleaning of Piping

Before installing pipe, thoroughly clean it of sand, mill scale and other foreign material. After erection but before final connections are made to apparatus thoroughly clean the interior of piping. Flush with water piping except air and fuel lines, in addition, blow out steam lines with intermittent high pressure steam blows to promote shedding of internal scale. Take care during fabrication and installation, to keep piping, valves, fittings and specialties free of loose welding metal chips of metal

or slag, welding rods and other foreign matter. Blowing or flushing shall in no case be channeled through equipment, pump, control valve, regulating valve, instrument gage or specialty in the system. Provide temporary screens, strainers, connections, spool pieces and bypasses consisting of piping or hoses, pumps and other required equipment temporarily installed for the purpose of cleaning and flushing piping. Drain flushing water and test water to the sanitary sewer system.

3.1.2.10 Reduction in Pipe Size

Provide reducing fittings for changes in pipe size; the use of bushings will not be permitted. In horizontal steam lines, reducing fittings shall be the eccentric type to maintain the bottom of the lines in the same plane. In horizontal water mains, reducers shall be set to maintain the top of the lines in the same plane.

3.1.2.11 Expansion Control

Provide bends, loops, and offsets wherever practical to relieve overstressed piping systems due to thermal expansion and to provide adequate flexibility. Cold springing of piping system is prohibited.

3.1.2.12 Connection to Equipment

Provide unions or flanges where necessary to permit easy disconnection of piping and apparatus. Provide unions and gate valves at each connection to threaded end control valves, strainers and equipment.

3.1.2.13 Valve Installation

Install valves in positions accessible for operation and repair. Install stems in a vertical position with handwheels or operators on top or in a horizontal position. Do not install handwheels on stop valves below the valve. When centerline of valve is more than 7 feet above floor or platform, provide valve with a chain-operated handwheel. When valve is motorized, provide hand operation for emergency use.

- a. Steam Pressure-Reducing Valves: Provide the steam line entering each pressure-reducing valve with a strainer. Provide each pressure-reducing valve unit with two shutoff valves and with a globe or angle bypass valve and bypass pipe. A bypass around a reducing valve shall be of reduced size to restrict its capacity to approximately that of the reducing valve. Provide each pressure-reducing valve unit with indicating steam gages to show the reduced pressure and the upstream pressure and an adequately sized safety valve on the low pressure side.
- b. Valve Tags and Charts: Permanently tag each valve with a black and white engraved laminated plastic tag showing valve number, valve function and piping system and whether another valve must be opened or closed in conjunction with this valve. Provide a typed chart which will show the required valve tagging plus the location of each valve. Frame valve charts under glass and install as directed.

3.1.2.14 Traps and Connections

Traps shall be of the type and capacity for the service required, and shall be properly supported and connected. Install traps with a dirt pocket and strainer between it and the piping or apparatus it drains. When it is

necessary to maintain in continuous service apparatus or piping which is to be drained, provide a three valve bypass so that trap may be removed and repaired and condensate drained through the throttled bypass valve. Provide a check valve on discharge side of trap whenever trap is installed for lift or operating against a back pressure, or it discharges into a common return line. Provide test connections on discharge side of high and medium pressure traps when they are specifically required. Test connection shall include a 1/2 inch globe valve with open blow.

3.1.2.15 Pressure Gage Installation

Provide with a shutoff valve or petcock between the gage and the line, and gage on steam lines shall have a siphon installed ahead of the gage.

3.1.2.16 Thermometer and Sensing Element Installation

Provide thermometers and thermal sensing elements of control valves, with a separable socket. Install separable sockets in pipe lines in such a manner to sense flowing fluid temperature and minimize obstruction to flow.

3.1.2.17 Strainer Locations

Provide strainers with meshes suitable for the services upstream of each control valve and where dirt might interfere with the proper operation of valve parts, orifices, or moving parts of equipment.

3.1.2.18 Dissimilar Piping Materials

Provide dielectric unions or flanges between ferrous and nonferrous piping, equipment, and fittings, except that bronze valves and fittings may be used without dielectric couplings for ferrous-to-ferrous or nonferrous-to-nonferrous connections. Dielectric fittings shall utilize a nonmetallic filler which will prevent current flow from exceeding one percent of the short circuit current. Spacer shall be suitable for the pressure and temperature of the service. Fittings shall otherwise be as specified in this section.

3.1.2.19 Surface Treating, and Pipe Wrapping

Uninsulated steel piping buried in the ground shall have exterior surfaces protected with a tape wrapping system or a continuously extruded polyethylene coating system.

3.1.3 Painting

3.1.3.1 Piping, Fittings, and Mechanical and Electrical Equipment

Equipment shall be factory finished to withstand the intended end use environment in accordance with the specifications for particular end item. Factory finished equipment on which the finish has been damaged shall have damaged areas retouched and then be given a complete finish coat to restore the finish to its original condition. Finish coat shall be suitable for exposure in the intended end use environment.

3.1.3.2 Other Items

Unless specified otherwise, pipe hangers, structural supports, pipe and pipe fittings, conduit and conduit fittings, pipe coverings, insulation, and metal surfaces associated with mechanical and electrical equipment

shall be painted utilizing the painting systems as specified in Section 09890 PROTECTIVE COATINGS OF CARBON STEEL. Except zinc-coated and copper pipe, give piping to be insulated, a protective coating prior to installing insulation.

3.1.3.3 Surfaces Not to be Painted

Unless specified otherwise, do not paint equipment having factory applied permanent finish, switchplates and nameplates, motor starters, and concrete foundations.

3.1.4 Insulation

Insulate mechanical equipment, systems and piping as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.2 FIELD QUALITY CONTROL

Provide labor, equipment, test apparatus and materials required for preparation and performance of tests and inspections specified to demonstrate that the auxiliary equipment as installed are in compliance with contract requirements. During startup and during tests, factory trained engineers or technicians employed by the system suppliers or manufacturers of such components as the feedwater treatment equipment, and other auxiliary equipment shall be present, to ensure the proper functioning, adjustment, and testing of the individual components and systems. The Government will furnish, when available, water, electricity and fuel for the tests, except fuel required for retesting. The Contractor shall rectify defects disclosed by the tests and retest the equipment. The Contractor's boiler plant personnel shall be experienced in starting up and operating boiler plants.

3.2.1 Tests and Inspections (Piping)

3.2.1.1 General Requirements

Examine, inspect, and test piping in accordance with ASME B31.3 except as modified below. The Contractor shall rectify defects disclosed by the tests. Necessary subsequent tests required to prove system tight after additional work by the Contractor shall be provided by the Contractor. Make tests under the direction of and subject to the prior approval of the Contracting Officer.

3.2.1.2 Hydrostatic and Leak Tightness Tests

- a. Test piping which is a part of the steam generation or auxiliary systems, including piping within the boiler room and external to the boiler room, by the following methods:
 1. Perform hydrostatic test for welded and screwed steel piping systems except those for air, oil, and gas. Hold hydrostatic tests for a period of 10 minutes with no pressure loss. Temperature of the testing fluid shall not exceed 100 degrees F.
 2. Test air lines in accordance with the requirements of ASME B31.3 for pneumatic tests with the exception that the test pressure must be held for one hour. Examination for leaks by a soap or other foaming agent test.

- b. For tests install a calibrated test pressure gage in the system to observe loss in pressure.

3.2.2 Preliminary Operation

The Contractor under the direction of the respective manufacturer's representative shall perform the work of placing into operation equipment provided except as specifically noted otherwise. Make adjustments to equipment that are necessary to ensure proper operation as instructed by the manufacturer of the equipment.

- a. Lubricate equipment prior to operation in accordance with the manufacturer's instructions. Lubricants shall be provided by the Contractor. Contractor shall furnish lubrication gun with spare cartridges of lubricant to operating personnel.
- b. Dry out motors before operation as required to develop and maintain proper and constant insulation resistance.
- c. Check drive equipment couplings for proper alignment at both ambient and operating temperature conditions.

3.2.3 General Startup Requirements

Prior to initial operation of any complete system, check each component as follows:

- a. Inspect bearings for cleanliness and alignment and remove foreign materials found. Lubricate as necessary and in accordance with manufacturer's recommendations. Replace bearings that run roughly or noisily.
- b. Adjust direct drives for proper alignment of flexible couplings. Provide lubrication when a particular coupling so requires. Check security of couplings to driver shafts. Set drive components to ensure free rotation with no undesirable stresses present on the coupling of attached equipment.
- c. Check motors for amperage comparison to nameplate value. Correct conditions that produce excessive current flow and that exist due to equipment malfunction.
- d. Check speeds of each motor and driven apparatus to ensure that they are operating at the desired point.
- e. Check actual suction and discharge pressure of each pump against desired performance curves.
- f. Check pump packing glands or seals for cleanliness and adjustment before running each pump. Inspect shaft sleeves for scoring and proper placement of packing; replace when necessary. Ensure piping system is free of dirt and scale before circulating liquid through pumps.
- g. Inspect both hand and automatic control valves. Clean bonnets and stems, tighten glands to ensure no leakage, but permit valve stems to operate without galling. Replace packing in valves that require same to retain maximum adjustment after system is judged complete. Replace entire packing in valves that continues to leak after adjustment. Remove and repair bonnets that leak. Coat packing gland threads and

valve stems with a suitable surface preparation after cleaning.

- h. Inspect and make certain that control valve seats are free from foreign material and are properly positioned for the intended service.
- i. Check flanges and packing glands after the system has been placed in operation. Replace gaskets in flanges that show signs of leakage after tightening.
- j. Inspect screwed joints for leakage and remake each joint that appears to be faulty. Do not wait for rust to form. Clean threads on both parts, apply compound and remake joint.
- k. Strainers installed shall be thoroughly blown out through individual valved blow-off connection on each strainer prior to placing in operation.
- l. Thoroughly blow out or dismantle and clean strainers after systems have been in operation one week. Thoroughly clean, repair, and place back in service traps or other specialties in which foreign matter has accumulated, causing malfunction or damage.
- m. Adjust pipe hangers and supports for correct pitch and alignment.
- n. Remove rust, scale and foreign materials from equipment and renew defaced surfaces. When equipment is badly marred, the Contracting Officer shall have the authority to request that new materials be provided.
- o. Adjust and calibrate temperature, pressure and other automatic control systems.
- p. Inspect each pressure gage and thermometer for calibration, and replace those that are defaced, broken or read incorrectly.

3.2.4 Fans, Heaters, Pumps, and Motors

Test electric motors to determine compliance with the referenced standards. Standard symbols and certifications from the referenced organization may be accepted at the discretion of the Contracting Officer. Closely observe the operation of electric motors for possible defects or nonconformance.

3.2.5 Auxiliaries Tests and Inspections

The Contractor, with qualified personnel provided by the Contractor, shall make tests and inspections at the site under direction of and subject to approval of the Contracting Officer. The respective manufacturer's representatives and consultants shall direct the Contractor's boiler plant personnel in the operation of near appurtenances through the entire testing period and shall ensure that necessary adjustments have been made. The Contractor shall notify the Contracting Officer in writing, at least 7 days in advance, indicating that equipment is ready for testing. The Contractor shall provide testing equipment, including gages, thermometers, and other test apparatus and calibrate instruments prior to the test. Steam flow may be measured by permanent gages and meters installed previously. The Contractor shall perform the following tests in the sequence as listed when feasible:

- a. Preliminary operational tests (steady state combustion test and variable load combustion test)
- b. Tests of auxiliary equipment
- c. Feedwater equipment test
- d. Capacity and efficiency tests

3.2.5.1 General Controls Operational Tests

Conduct operational tests, performance tests, and demonstration tests with boiler controls functional and on line. No bypassing, use of jumpers, or other disablement of control systems will be allowed unless specified elsewhere.

3.2.5.2 Auxiliary Equipment and Accessory Tests

Observe and test stop valves, try cocks, fans, fuel oil heaters, pumps, electric motors, and other accessories and appurtenant equipment during operational and capacity tests for leakage, malfunctions, defects, and for compliance with referenced standards.

3.2.5.3 Feedwater Equipment Tests

Perform tests of feedwater treatment equipment in two steps. Conduct one test concurrently with the combustion tests. The Government will perform a second test during the first period of heavy loading after plant has been accepted and put in service. Correct deficiencies revealed during the Government tests under the guarantee provisions of the contract. Both the first and second series of tests shall determine compliance with limits for chemical concentrations of this specification. Supply equipment for taking samples and test kit for analyzing samples. Sampling equipment and test kit shall become the property of the Government when tests are completed.

3.2.5.4 Test Runs

Subsequent tests required because of failure of equipment to perform adequately during specified capacity and efficiency tests shall be financial responsibility of the Contractor, including fuel cost.

3.2.6 Manufacturer's Field Services

3.2.6.1 Erection/Installation Supervisors and Service Engineers

Service Engineers: Services of the manufacturing companies' service engineers and the system suppliers' service engineers shall be provided by the Contractor to advise during erection and installation of other systems and equipment such as boiler feedwater pumps, water treatment equipment, chemical feed pumps, and deaerating feedwater heater.

3.2.6.2 System Representatives

Furnish factory trained engineers or technicians who are representatives of the system suppliers to supervise testing of the boilers and auxiliary equipment.

3.2.6.3 Instruction to Government Personnel

In accordance with the provisions of Section 15050 BASIC MECHANICAL MATERIALS AND METHODS, supervisors and service engineers shall provide instruction for the Government's operators in the operation and maintenance of the equipment furnished under this section. The minimum number of hours of instruction provided shall be as follows:

<u>Equipment</u>	<u>Operation Instruction</u>	<u>Maintenance Instruction</u>
Boiler feedwater pumps	8 hours	8 hours
Deaerator heater and Miscellaneous equipment	16 hours	16 hours

3.3 WASTE MANAGEMENT

Separate waste in accordance with the Waste Management Plan, placing copper materials and ferrous materials in designated areas for reuse. Close and seal tightly all partly used adhesives and solvents; store protected in a well-ventilated, fire-safe area at moderate temperature.

-- End of Section --

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1.4.5

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WELDING PRESSURE PIPING

04/06

PART 1 GENERAL

1.1 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 SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

- ASNT RP SNT-TC-1A (2006) Recommended Practice
- ASNT CP-189 (2006) Qualification and Certification of Nondestructive Testing Personnel

AMERICAN WELDING SOCIETY (AWS)

- AWS A2.4 (2007) Standard Symbols for Welding, Brazing and Nondestructive Examination
- AWS A3.0 (2001; Errata 2001) Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting and Thermal Spraying
- AWS B2.1 (2009) Welding Procedure and Performance Qualification
- AWS D1.1/D1.1M (2008; Errata 2009) Structural Welding Code - Steel
- AWS QC1 (2007) AWS Certification of Welding Inspectors
- AWS Z49.1 (2005) Safety in Welding, Cutting and Allied Processes

ASME INTERNATIONAL (ASME)

- ASME B31.3 (2008) Process Piping
- ASME BPVC SEC VIII (2007; Addenda 2008) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels
- ASME BPVC SEC II-C (2007; Addenda 2008) Boiler and Pressure Vessel Code; Section II, Materials, Part C - Specifications for Welding Rods, Electrodes and Filler Metals
- ASME BPVC SEC IX (2007; Addenda 2008) Boiler and Pressure Vessel Code; Section IX, Welding and

Brazing Qualifications

ASME BPVC SEC V

(2007; Addenda 2008) Boiler and Pressure Vessel Code; Section V, Nondestructive Examination

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

29 CFR 1910

Occupational Safety and Health Standards

29 CFR 1926

Safety and Health Regulations for Construction

1.2 RELATED REQUIREMENTS

Section 15050 BASIC MECHANICAL MATERIALS AND METHODS of the Ames Standard Construction Specification (ASCS) applies to this section with the additions and modifications specified herein.

1.3 SUBMITTALS

Government approval is required for submittals. The following shall be submitted in accordance with Section 01300 (ASCS) SUBMITTALS:

SD-02 Shop Drawings

Welding pressure piping

SD-07 Certificates

Welding procedures qualification

Welder certification records and ID stamps

Certified Material Test Reports (CMTR) for weld rods

Nondestructive examination (NDE) procedures

NDE personnel certification procedures

Inspector certification

Submit inspector certification and NDE personnel certification for record.

SD-11 Closeout Submittals

Field weld drawings

Weld identifications

Weld maps

Welding procedures

Quality Control and Traveler's Records

1.4 QUALITY ASSURANCE

1.4.1 Welding Pressure Piping

Show location, length, and type of welds, and indicate postweld heat treatment and nondestructive testing as required.

Preheat and heat treatment shall comply with ASME B31.3, paragraph 330.

1.4.2 Procedures

Develop and qualify procedures for welding metals included in the work. Do not start welding until welding procedures, welders, and welding operators have been qualified. Perform qualification testing by an approved testing laboratory, or by the Contractor if approved by the Contracting Officer in accordance with the qualified procedures. Notify the Contracting Officer at least 24 hours in advance of the time and place of the tests. When practicable, perform the qualification tests at or near the work site. Maintain current records of the test results obtained in welding procedure, welding operator/welder performance qualifications, and nondestructive examination (NDE) procedures. These records shall be readily available at the site for examination by the Contracting Officer. Qualify the procedures for making transition welds between different materials or between plates or pipes of different wall thicknesses. ASME B31.3 requirements for branch connections may be used in lieu of detailed designs. Unless otherwise specified, the choice of welding process shall be the responsibility of the Contractor.

1.4.2.1 Previous Qualifications

Welding procedures, welders, and welding operators previously qualified by test may be accepted for the work without requalification provided that the following conditions are fulfilled:

- a. Copies of welding procedures, procedure qualification test records, and welder and welding operator performance qualification test records are submitted and approved in accordance with the paragraph entitled "Submittals."
- b. Testing was performed by an approved testing laboratory or technical consultant or by the Contractor's approved quality control organization.
- c. The welding procedures, welders, and welding operators were qualified in accordance with ASME BPVC SEC IX, AR-2 level; and base materials, filler materials, electrodes, equipment, and processes conformed to the applicable requirements of this specification.
- d. The requirements of paragraph entitled "Welder and Welding Operator Performance Qualification" for renewal of qualification were met, and records showing name of employer and period of employment using the process for which qualified are submitted as evidence of conformance.

1.4.2.2 Performance

The Contractor shall be responsible for the quality of joint preparation, welding, and examination. Clearly identify and record materials used in the welding operations. The examination and testing defined in this specification are minimum requirements. Provide additional examination and testing as necessary to achieve the quality required.

1.4.3 Welding Procedures Qualification

Qualification of the welding procedures for each group of materials to be welded is required as indicated in [ASME BPVC SEC IX](#). Record in detail and qualify the "Welding Procedure Specifications" for every welding procedure proposed. Qualification for each welding procedure shall conform to the requirements of ASME Standards and to this specification. The welding procedures shall specify end preparation for welds, including cleaning, alignments, and root openings. Preheat, interpass temperature control, and postheat treatment of welds shall be as required by ASME Piping documents, unless otherwise indicated or specified. Backing rings shall not be permitted. Welding procedure qualifications shall be identified individually and referenced on the shop drawings or suitably keyed to the contract drawings.

1.4.4 Welder and Welding Operator Performance Qualification

Qualify each welder and welding operator assigned to work covered by [ASME BPVC SEC IX](#) by performance tests using equipment, positions, procedures, base metals, and electrodes or bare filler wires from the same specification, classification, or group number that will be encountered on his assignment. Welders or welding operators who make acceptable procedure qualification tests will be considered performance-qualified for the welding procedure used. Determine performance qualification in accordance with [ASME BPVC SEC IX](#), [ASME B31.3](#), and as specified.

1.4.5 Renewal of Qualification

Requalification of a welder or welding operator shall be required under one or any combination of the following conditions:

- a. When a welder or welding operator has not used the specific welding process for a period of 3 months. The period may be extended to 6 months if the welder has been employed on another welding process.
- b. There is specific reason to question the welder's ability to make welds that will meet the requirements of the specifications.
- c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract and a qualification test has not been taken within the preceding 12 months. Renewal of qualification under this condition need be made on only a single test joint or pipe of any thickness, position, or material to reestablish qualification for any thickness, position, or material for which the welder or welding operator had qualified previously.

1.4.6 Qualification of Inspection and (NDE) Personnel

Qualification of Inspection and Nondestructive Examination (NDE) Personnel: Qualify inspection and nondestructive examination personnel in accordance with the following requirements:

1.4.6.1 Inspector Certification

Qualify welding inspectors in accordance with [ASME B31.3](#) and [ASNT RP SNT-TC-1A](#) or [ASNT CP-189](#).

1.4.6.2 NDE Personnel Certification Procedures

Certify NDE personnel and establish a written procedure for the control and administration of NDE personnel training, examination, and certification. Base procedures on appropriate specific and general guidelines of training and experience recommended by ASNT RP SNT-TC-1A, Supplement A-Radiographic, Supplement B-Magnetic particle, Supplement C-Ultrasonic, and Supplement D-Liquid Penetrant, and ASNT CP-189.

1.4.6.3 Welding Procedures and Qualifications

- a. Specifications and Test Results: Submit copies of the welding procedure specifications and procedure qualification test results for each type of welding required. Approval of any procedure does not relieve the Contractor of the responsibility for producing acceptable welds. Submit this information on the forms printed in ASME BPVC SEC IX or their equivalent.
- b. Certification: Before assigning welders or welding operators to the work, submit their names, together with certification that each individual is performance qualified as specified. Do not start welding work prior to procedure qualification. The certification shall state the type of welding and positions for which each is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification tests.

1.4.7 Symbols

Conform to AWS A2.4.

1.4.7.1 Weld Identifications

Submit a list of the welders' names and symbol for each welder. To identify welds, submit written records indicating the location of welds made by each welder or welding operator.

1.4.8 Safety

Conform to AWS Z49.1, 29 CFR 1910-SUBPART Q, "Welding, Cutting, and Brazing," 29 CFR 1926-SUBPART J, "Welding and Cutting."

1.5 ENVIRONMENTAL

Do not perform welding when the quality of the completed weld could be impaired by the prevailing working or weather conditions. The Contracting Officer will determine when weather or working conditions are unsuitable for welding.

1.6 DELIVERY AND STORAGE

Deliver filler metals, electrodes, fluxes and other welding materials to the site in manufacturers' original packages and store in a dry space until used. Label and design packages properly to give maximum protection from moisture and to assure safe handling.

PART 2 PRODUCTS

2.1 WELDING MATERIALS

Comply with ASME BPVC SEC II-C and ASME B31.3. Welding equipment, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator using qualified welding procedures.

PART 3 EXECUTION

3.1 WELDING

Do not deviate from applicable codes, approved procedures and approved shop drawings without prior written approval from the Contracting Officer. Materials or components with welds made off the site will not be accepted if the welding does not conform to the requirements of this specification unless otherwise specified. Assign each welder or welding operator an identifying number, letter, or symbol that shall be used to identify his welds. Each welder or welding operator shall apply his mark adjacent to his weld using an approved low impact, permanent, metal stamp or other approved methods that do not deform the metal. For seam welds, place identification marks adjacent to the welds at 3 foot intervals. Confine identification by die stamps or electric etchers to the weld reinforcing crown, preferably in the finished crater.

3.2 WELDING OPERATORS

Perform welding in accordance with qualified procedures using qualified welders and welding operators.

3.3 SUPPORTS

Welding of hangers, supports, and plates to structural members shall conform to AWS D1.1/D1.1M.

3.4 EXAMINATIONS AND TESTS

Examination of piping and piping elements shall be in accordance with ASME B31.3 Section 341.

Visual and nondestructive examinations shall be performed by the Contractor to detect surface and internal discontinuities in completed welds. Employ the services of a qualified commercial inspection or testing laboratory or technical consultant approved by the Contracting Officer. Visually examine welds. Examination shall be required as indicated in Tables IV attached to this section. Random RT testing applies to each welder for each lot of piping including, as a minimum, separate lots for shop and field welding. When examination and testing indicates defects in a weld joint, a qualified welder shall repair the weld in accordance with the paragraph entitled "Corrections and Repairs" of this section.

3.4.1 Random RT Testing

Radiographic examination shall comply with ASME B31.3, paragraph 341.4.1(b), to include 5% for each welder for each lot, with separate lots for shop and field welds as a minimum. When defects are revealed, progressive examination shall comply with ASME B31.3, paragraph 341.3.4, and defective workmanship shall be corrected per paragraph 341.3.3.

3.4.2 Visual Examination

Visually examine welds per paragraph 341.4.1(a) and 344.2, including, but not limited to:

- a. Before welding -- for compliance with requirements for joint preparation, consumable inserts, alignment and fit-up, and cleanliness.
- b. During welding -- for conformance to the qualified welding procedure.
- c. After welding -- for cracks, contour and finish, bead reinforcement, undercutting, overlap, and size of fillet welds.

3.4.3 Nondestructive Examination

NDE shall be in accordance with written procedures. Procedures for radiographic, liquid penetrant, magnetic particle, or ultrasonic tests and methods shall conform to ASME BPVC SEC V. The approved procedure shall be demonstrated to the satisfaction of the Contracting Officer's QA personnel. In addition to the information required in ASME BPVC SEC V, the written procedures shall include:

- a. Timing of the nondestructive examination in relation to the welding operations.
- b. Safety precautions.

3.4.4 Review of Examinations and Tests by the Government

Results of examinations and tests will be reviewed and approved by the Government.

3.5 ACCEPTANCE STANDARDS

Acceptance criteria shall comply with ASME B31.3, paragraph 341.3.2.

3.6 CORRECTIONS AND REPAIRS

Remove defects and replace welds as specified in ASME B31.3, unless otherwise specified. Repair defects discovered between weld passes before additional weld material is deposited. Wherever a defect is removed, and repair by welding is not required, the affected area shall be blended into the surrounding surface eliminating sharp notches, crevices, or corners. After defect removal is complete and before rewelding, reexamine the area by the same test methods which first revealed the defect to ensure that the defect has been eliminated. After rewelding, reexamine the repaired area by the same test methods originally used for that area. For repairs to base material, the minimum examination shall be the same as required for butt welds. Indication of a defect shall be regarded as a defect unless reevaluation by NDE or by surface conditioning shows that no unacceptable indications are present. The use of foreign material to mask, fill in, seal, or disguise welding defects will not be permitted. Progressive sampling for re-examination per ASME B31.3, paragraph 341.3.3 and 341.3.4, is required after defects are revealed.

TABLE IV

EXAMINATIONS AND TESTS FOR VARIOUS MATERIALS AND SERVICES

Examinations or Tests Required

Material or Application	Visual	Radiographic	Magnetic Particle or Liquid Penetrant	Ultra-sonic
High-alloy austenitic or nickel steels or nickel alloys for cryogenic service and vacuum service				
a. Tack welds	Yes	No	No	No
b. Root passes	Yes	No	Yes	No
c. Intermediate passes	Yes	No	No	No
d. Completed weld	Yes	100% for NPS over 1 1/4" 60 percent for NAPA PS 1 1/4" and less	Yes (PT only) 1/2" and over	Yes for wall thickness
High-alloy austenitic or nickel steels or nickel alloys for other than cryogenic or vacuum service				
a. Tack welds	Yes	No	No	No
b. Root passes	Yes	No	Yes	No
c. Intermediate passes	Yes	No	No	No
d. Completed weld	Yes	Random	Yes (PT only)	Yes
Stainless steel to carbon steel				
a. Completed weld	Yes	Random	Yes (PT only)	No
Carbon steel piping systems				
a. Tack welds	Yes	No	No	No
b. Root passes	Yes	No	Yes MT	No
c. Intermediate passes	Yes	No	No	No
d. Completed weld	Yes	Random	Yes MT	No

-- End of Section --