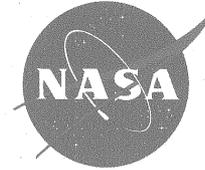


National Aeronautics and  
Space Administration  
**Dryden Flight Research Center**  
P.O. Box 273  
Edwards, CA 93523-0273



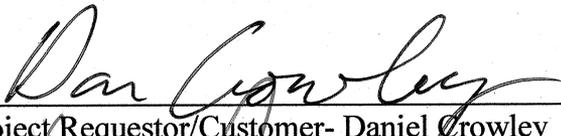
January 30, 2012

Subject: Project Approval Signatures:  
**FY12 REPAIR CENTER-WIDE FIRE MAINS**

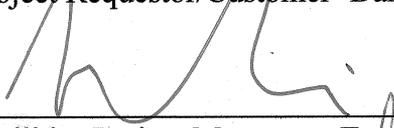
I have reviewed the attached Specifications for the subject construction project, and find to the best of my knowledge, that they meet current program requirements and comply with current codes.

  
\_\_\_\_\_  
Chief, Facility Engineering & Asset Management Office- Daniel Crowley

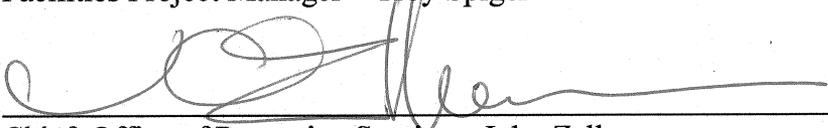
2-1-12  
Date

  
\_\_\_\_\_  
Project Requestor/Customer- Daniel Crowley

2-1-12  
Date

  
\_\_\_\_\_  
Facilities Project Manager – Troy Spiger

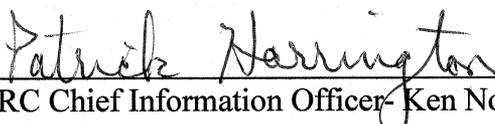
1-31-12  
Date

  
\_\_\_\_\_  
Chief, Office of Protective Services- John Zellmer

02/01/2012  
Date

  
\_\_\_\_\_  
Chief, Safety, Health & Environmental Office- Barton Henwood

2-1-12  
Date

  
\_\_\_\_\_  
DFRC Chief Information Officer- Ken Norlin

1 Feb 12  
Date

# SPECIFICATIONS

DESIGN SUBMITTAL "C" – 100%

NASA DFRC EDM-1697

REPAIR CENTERWIDE  
FIRE MAIN

Edwards Air Force Base, CA

July 29, 2011



Development One Services,  
Inc.  
1611 East 4<sup>th</sup> Street, Suite 250  
Santa Ana, CA 92701

SECTION 01 11 00

SUMMARY OF WORK  
01/08

PART 1 GENERAL

1.1 SUMMARY

The work to be performed under this project consists of providing the labor, equipment, and materials to perform FY12 Repair Centerwide Fire Main for the National Aeronautics and Space Administration at the Dryden Flight Research Center (NASA/DFRC), Edwards, California 93523.

- a. The site work scope includes: Replacement of existing cast iron, ductile iron, and asbestos cement fire water mains with class 200 PVC fire water mains, and pertinent fixtures. Refurbishment of Fire Water Tanks and related work. See contract drawings and specifications for further information.
- b. The electrical scope includes: Installation of electrical connections to new control panels and sensors, and general devices. See contract drawings and specifications for further information.
- c. The fire protection scope includes: Installation of tamper switches, tank monitoring, fire alarm control panel modifications, and fire alarm devices. See contract drawings and specifications for further information.

1.1.1 Separate Construction Phases

The contractor shall perform the work in seven (7) distinct and separate phases as outlined on the project drawings. The Contractor shall perform work on one phase at a time. After completion of each phase of construction a final inspection will be performed by the Government prior to work commencing in the next phase. Once the work in one phase is completed and accepted by the Government, the Contractor will be issued a Notice to Proceed for the next phase.

The government reserves the right to change the order of the phasing prior to the start of construction of that phase. The order of these phases is mandatory. The order of phase execution is: 1, 2, 3, 4, 5, 6, 7. No deviations from this phasing sequence will be allowed. The area of each phase is shown in the contract drawings.

1.1.2 Base Bid and Options

The contract is structured as base bid work and four (4) options.

Base Bid - The base bid work includes: Provide all materials, equipment and labor to construct the scope of work for the repair fire water infrastructure project as shown and described in the contract drawings and specifications; located at Nasa Dryden Flight Research Center, Edwards AFB, CA 93523; with the exception of the work described hereafter and included in additive bid options #1 through #4.

Option 1 - Option 1 work includes: Provide all materials, equipment and

labor to safely demolish and install new 12" to 3" fire fire water piping and valves shown clouded on contract drawing C-11 and C-12. Work also includes demolishing and replacing Post Indicating Valves (PIV's), fire hydrants, Fire Department Connection (FDC) assemblies, pavement, grading work, and earthwork. If option is not exercised then the contractor shall connect new fire water piping to existing fire water piping with 12" DI bends and adapter couplings.

Option 2 - Option 2 work includes: Provide all materials, equipment and labor to safely to install new 50,000 gallon fire water tank, all tank appurtances, level sensors, cathodic protection, tank foundation, grading & earthwork, pavement repair, new 6" fill pipe, new 12" recirculation pipe, new 20" suction piping, valves, tamper switches, and new power which are all shown on contract drawings C-10, E-2, and FA-4. Work includes connection to building 4840 fire pump room. Work does not include new 20-inch mainline street piping and fire hydrants shown on contract drawing C-10.

Option 3 - Option 3 work includes: Provide all materials, equipment and labor to safely demolish and install new 20" fire water piping shown clouded on contract drawing C-5. Work also includes demolishing and replacing concrete pavement, grading, and earthwork. If option is not exercised then the contractor shall connect new fire water piping to existing fire water piping with 20" DI bends and adapter couplings.

Option 4 - Option 4 work includes: Provide all materials, equipment and labor to safely demolish and install new 20" to 3" fire water piping & valves shown clouded on contract drawings C-10, C-11, E-2, and FA-3. Work includes demolishing and replacing backflow preventer assemblies, PIVs, fire hydrants, FDC assemblies, meters, and pavement. Work includes tank painting & replacing tank cathodic protection. The work includes grading work and earthwork. Work includes tamper switches, tank monitoring, fire alarm control panel modifications, fire alarm device work, fuel tank work, and power. If option is not exercised then the contractor shall connect new fire water piping to existing fire water piping with 20" DI bends and adapter couplings.

## 1.2 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.

### ASTM INTERNATIONAL (ASTM)

ASTM E 2114	(2008) Standard Terminology for Sustainability Relative to the Performance of Buildings
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## 1.3 DEFINITIONS

Definitions pertaining to sustainable development are as defined in ASTM E 2114 and as specified.

- a. "Environmentally preferable products" have a lesser or reduced effect on the environment in comparison to conventional products and services. This comparison may consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, or disposal of the product.

- b. "Indoor environmental quality" is the physical characteristics of the building interior that impact occupants, including air quality, illumination, acoustics, occupant control, thermal comfort, daylighting, and views.
- c. "Operational performance" is the functional behavior of the building as a whole or of the building components.
- d. "Sustainability" is the balance of environmental, economic, and societal considerations.

#### 1.4 CONTRACT DRAWINGS

Drawings and documents that accompany this specification are a part thereof, and are listed in section 00 01 15 List of Drawings.

Digital drawings and specifications will be furnished to the Contractor without charge. Reference publications will not be furnished. The Contractor shall immediately check furnished drawings and notify the Government of any discrepancies.

#### 1.5 PHASED CONSTRUCTION SCHEDULE

Within the overall project schedule of 340 days, including the base bid and all options, the Contractor shall commence and complete the work in phases.

#### 1.6 WORK HOURS

All Construction work under this contract shall be performed during normal duty hours, unless otherwise approved by the Contracting Officer. (Normal duty hours are defined in Section 01 14 00 "WORK RESTRICTIONS".) Weekends and Government holidays may be restricted for work.

The Contractor shall allow for a maximum of ten (10) days per year where construction activity is not permitted because NASA facilities are closed.

#### 1.7 REQUIRED OPERATIONAL SYSTEMS AND UTILITIES

The Contractor shall ensure that all existing building fire suppression systems shall not be "out of service" for more than 4 hours in 1 work week without permission by Contracting Officer.

The Contractor shall ensure that when an existing fire hydrant is taken "out of service", the new designated fire hydrant replacement shall be put "in service" within 4 hours.

The Contractor shall provide traffic control to minimize the impact to traffic access during construction. Temporary road closure(s) will be approved by the Contracting Officer prior to the closure.

All outages shall be coordinated in advance according to Section 01 35 14.11 40 DRYDEN SAFETY REQUIREMENTS.

#### PART 2 PRODUCTS

Not used.

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PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 14 00

WORK RESTRICTIONS  
07/07

PART 1 GENERAL

1.1 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00  
SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of Contact Personnel; G

1.2 CONTRACTOR ACCESS AND USE OF PREMISES

1.2.1 Activity Regulations

Contractor personnel employed on the Activity shall become familiar with and obey Activity regulations including safety, fire, traffic and security regulations according to Section 01 35 14.11 40 "Dryden Safety Requirements." Contractor personnel shall keep within the limits of the work and avenues of ingress and egress. To minimize traffic congestion, delivery of materials shall be outside of peak traffic hours (Peak traffic hours are 6:30 to 8:00 a.m. and 3:30 to 5:00 p.m.) unless otherwise approved by the Contracting Officer. Contractor personnel shall not enter any restricted areas unless required to do so and until cleared for such entry. The Contractor's equipment shall be conspicuously marked for identification.

1.2.1.1 MATERIAL AND EQUIPMENT

Shipments shall be addressed to the Contractor who shall be responsible for their receipt, unloading, handling, and storage at the site. The Government will not accept deliveries on behalf of the Contractor or Subcontractors or assume responsibility for security of materials, equipment, or supplies delivered to the site. The Contractor shall not have any material or equipment deliveries made to the DFRC shipping and receiving warehouse. The Contractor shall use the following address:

(Name of Contractor's firm or company)  
P.O.C. (Name of Contractor's superintendent or other employee)  
FY12 Repair Centerwide Fire Main  
Dryden Flight Research Center  
Edwards, CA 93524

The Contractor shall protect and preserve materials, supplies, and equipment of every description, including property which may be Government-furnished or Government-owned. Material to be salvaged and reinstalled by the Contractor shall be protected during removal and stored to prevent damage. Only material and construction equipment designated for performance of contract work may be stored at the construction site or located in Government-controlled areas.

Materials and equipment to be provided under this contract shall be standard catalogue products of manufacturers regularly engaged in the

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FINAL DESIGN

manufacture of the products. Material and equipment shall be installed in accordance with the requirements of the contract drawings and approved recommendations of the manufacturers.

1.2.1.2 Subcontractors and Personnel Contacts

Furnish a list of contact personnel of the Contractor and subcontractors including addresses and telephone numbers. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

1.2.1.3 Identification Badges

Identification badges will be furnished without charge. Application for and use of badges will be as directed. Contractor shall submit for approval on NASA Form DFRC-735 or DFRC-736, at least 15 days prior to the desired date of entry, a list of personnel who require entry into Government property to perform work on the project. Furnish a completed EMPLOYMENT ELIGIBILITY VERIFICATION (DHS FORM I-9) form for all personnel requesting badges. This form is available at [http://www.uscis.gov/files/form/I-9\\_IFR\\_02-02-09.pdf](http://www.uscis.gov/files/form/I-9_IFR_02-02-09.pdf). Immediately report instances of lost or stolen badges to the Contracting Officer.

1.2.1.4 Personnel Entry Approval

Failure to obtain entry approval will not affect the contract price or time of completion.

1.2.1.5 No Smoking Policy

Smoking is prohibited within and outside of all buildings on installations under the cognizance of NASA except in designated smoking areas. This applies to existing buildings, buildings under construction and buildings under renovation. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The Contracting Officer will identify designated smoking areas.

1.2.2 NORMAL DUTY HOURS

Normal duty hours for the Dryden Flight Research Center are from 6:00 am to 5:00 pm, Monday through Friday excluding holidays. The contractor's work shifts shall take place within the stated normal duty hours except as provided below.

1.2.2.1 Work Outside Normal Duty Hours

Work outside normal duty hours requires Contracting Officer approval. Make application 14 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number and project title. Based on the justification provided, the Contracting Officer may approve work outside normal duty hours. During periods of darkness, the different parts of the work shall be lighted in a manner approved by the Contracting Officer.

1.2.3 OCCUPANCY OF PREMISES DURING CONSTRUCTION

The buildings will be occupied during performance of work under this Contract. Before work is started, the Contractor shall arrange with the

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Contracting Officer a sequence of procedure, means of access, space for storage of materials and equipment, and use of approaches, corridors, and stairways. Government personnel will be allowed in the construction area to perform routine or emergency maintenance on building systems and equipment. This includes communication, electrical, mechanical, and fire protection systems.

1.3 ENVIRONMENTAL CONSIDERATIONS

The Edwards AFB property, which NASA shares, is on the National Priorities List (NPL, or Superfund) due to known areas of soil and groundwater contamination. Known contamination in soil has been cleaned up, and known contamination in shallow groundwater is under treatment but not yet cleaned up. The Contractor shall be aware that all intrusive activities that require a dig permit (greater than 6" deep) may also require vapor monitoring and use of Personal Protective Equipment (PPE) when work is occurring within these areas. The Dryden Safety, Health and Environmental Office reviews all applications for dig permits and will define requirements for vapor monitoring and personal protective equipment.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 20 00.00 20

PRICE AND PAYMENT PROCEDURES  
02/10

PART 1 GENERAL

1.1 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00  
SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Schedule of Values; G

SD-11 Closeout Submittals

Contractor's Invoice shall be submitted in accordance with  
Paragraph "CONTRACTOR'S INVOICE AND CONTRACT PERFORMANCE STATEMENT"

1.2 SCHEDULE OF VALUES

1.2.1 Data Required

Within 15 calendar days after Notice of Award, the Contractor shall prepare and deliver to the Contracting Officer a schedule of values for approval. The Schedule of Values shall consist of a detailed breakdown of each contract activity. The value of each activity shall be identified as a percentage of the total contract value, and shall correlate with the activities in the Project Schedule.

Contracting Officer will determine whether items in the Schedule of Values are appropriate. Progress payments shall be based on the approved Schedule of Values.

1.2.2 Schedule Instructions

Payments will not be made until the Schedule of Values has been submitted to and accepted by the Contracting Officer.

1.3 CONTRACTOR'S INVOICE AND CONTRACT PERFORMANCE STATEMENT

1.3.1 Content of Invoice

Requests for payment will be processed in accordance with the Contract Clause FAR 52.232-27. Invoices not completed in accordance with contract requirements will be returned to the Contractor for correction of the deficiencies. Requests for payment in accordance with the terms of the contract shall consist of:

- a. The Contractor's invoice on the form furnished by the Contracting Officer for this purpose, shall show in summary form the basis for arriving at the amount of the invoice.
- b. The contract performance statement on the form furnished by the Contractor for this purpose and consistent with the approved Schedule of Values, shall show in detail the estimated percentage of completion

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for each Definable Feature of Work (DFOW). The format, content, and number of copies required will be prescribed by the Contracting Officer and will be subject to his/her approval.

- c. Furnish a certificate to the CO with each payment request attesting that the work for which payment is requested, including stored material, is in compliance with contract requirements.
- d. The Estimate for Voucher, showing in detail the percentage of completion for each of the construction activities listed on the Schedule of Values.
- e. Updated Project Schedule and any reports required by the contract.
- g. Contractor Safety Self-Evaluation Checklist
- h. Weekly Certified Payroll Report
- i. Solid Waste Disposal Report
- j. Other supporting documents as requested
- k. For Final Payment: All closeout submittals must be received prior to final payment. A final invoice and the Contractor's Final Release is the Contractor's request for final payment, including completed As-Built Drawings. If the Contractor is incorporated, the Final Release shall contain the corporate seal. An officer of the corporation shall sign and the corporate secretary or official designee shall certify the Final Release.

No separate payments will be made for protection efforts necessitated by the safety provisions.

1.4 PAYMENTS TO THE CONTRACTOR

Payments will be made on submission of itemized requests by the Contractor will be subject to reduction for overpayments or increase for underpayments made on previous payments to the Contractor.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

02/10

PART 1 GENERAL

1.1 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00  
SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals  
Electronic Mail (E-Mail) Address

View location map; G

Progress and completion pictures; G

1.2 VIEW LOCATION MAP

Submit to the Contracting Officer, prior to or with the first digital photograph submittals, a sketch or drawing indicating the required photographic locations. Update as required if the locations are moved.

1.3 PROGRESS AND COMPLETION PICTURES

Photographically document site conditions prior to start of construction operations. Provide monthly, and within one month of the completion of work, digital photographs, 1600x1200x24 bit true color minimum resolution in JPEG file format showing the sequence and progress of work. Take regular digital photographs throughout the entire project from a minimum of ten views from points located by the Contracting Officer. Submit with the monthly invoice one set of digital photographs on a CD-R, cumulative of all photos to date. Indicate photographs demonstrating environmental procedures. Photographs for each month shall be in a separate monthly directory and each file shall be named to indicate its location on the view location sketch. The view location sketch shall also be provided on the CD as digital file. All file names shall include a date designator. Cross reference submittals in the appropriate daily report. Photographs shall be provided for unrestricted use by the Government.

1.4 SUPERVISION

Provide at least one (1) qualified Project Manager and one (1) qualified on-site Project Superintendent. The Project Manager must have a minimum 5 years' experience as a Project Manager or Superintendent on projects like this contract or similar in size and complexity. The Project Superintendent must have a minimum of 5 years' experience as a Superintendent on projects similar in size and complexity.

In addition to the above experience requirements, the Project Manager and on-site Project Superintendent shall complete the U.S. Army Corps of Engineers course entitled "Construction Quality Management for Contractors" prior to the start of construction.

The Project Manager in this context shall mean the individual with the responsibility for the overall management of the project and the Project

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Superintendent shall mean the individual with the responsibility for production. Both the Project Manager and Project Superintendent are subject to removal by the Contracting Officer for non-compliance with requirements specified in the contract and for failure to manage the project to ensure timely completion. Furthermore, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time for excess costs or damages by the Contractor.

Approval of Project Manager and on-site Project Superintendent is required prior to start of construction. Provide resumes for the proposed Project Manager and on-site Project Superintendent describing their experience with references and qualifications to the Contracting Officer for approval. The Contracting Officer reserves the right to interview the proposed Project Manager and on-site Project Superintendent at any time in order to verify the submitted qualifications.

#### 1.5 PROJECT MEETINGS

##### 1.5.1 Preconstruction Conference

The Contractor shall attend a preconstruction conference scheduled by the Contracting Officer. Work shall not commence prior to the conference. Discussion shall address project orientation, personnel contact, safety issues, permits, deficiencies, quality control and the location of the Contractor's office.

##### 1.5.2 Weekly Project Meetings

The Contractor shall attend weekly project meetings scheduled by the Government. Discussion shall address at a minimum: safety issues, quality control, submittals, progress schedule, schedule of submittals, as-built drawings, deficiencies, material delivery, permits, equipment delivery, invoices, potential factors of delay, request for information (RFIs), changes, and functional tests.

#### 1.15 PARTNERING

To most effectively accomplish this contract, the Government requires the formation of a cohesive partnership within the Project Team whose members are from the Government, the Contractor and their Subcontractors. Key personnel from NASA, the Contractor and Subcontractors, and the Designer of Record will be invited to participate in the Partnering process. The Partnership will draw on the strength of each organization in an effort to achieve a project that is without any safety mishaps, conforms to the Contract, and stays within budget and on schedule.

The Contracting Officer will provide Information on the Partnering Process and a list of key and optional personnel who should attend the Partnering meeting.

#### 1.6 Formal Partnering

Provide and host the Partnering sessions with key personnel of the Project Team, including Contractor personnel and Government personnel. Pay all costs associated with the Partnering effort including the Facilitator, the meeting room, and other incidental items. In exception, participants shall bear their own costs for meals, lodging, and transportation associated with

the Partnering sessions.

Before a Partnering session, coordinate with the Facilitator all requirements for incidental items (such as audio-visual equipment, easels, flipchart paper, colored markers, note paper, pens/pencils, colored flash cards, etc.), and have these items available at the Partnering session. Provide copies of documents for distribution to all attendees.

The Facilitator shall be experienced in conducting Partnering Workshops, and shall be acceptable to both the Government and the Contractor. The Facilitator is responsible for leading the team in a timely manner and making sure that issues are identified and resolved. A list of Partnering Facilitators is available from the Contracting Officer.

- a. The Initial Partnering Session shall be a duration of one day minimum. It shall be located at a place off the construction site, as agreed to by the Contracting Officer and the Contractor. It may take place concurrently with the Pre-Construction Meeting.
- b. The Follow-on Partnering Session(s) generally last a half day or less. Schedule them at 3 to six month intervals, or when needed. Participants are encouraged to utilize electronic means to expedite meetings. Meetings may be held at a location off-Base, at the project site, or in a Government Facility on Base. Follow-on meetings may be held concurrently with other scheduled meetings. Attendees need only be those required to resolve current issues. Recommend using the same Facilitator from the Initial Partnering session to achieve best results and for continuity.

#### 1.7 ELECTRONIC MAIL (E-MAIL) ADDRESS

The Contractor shall establish and maintain electronic mail (e-mail) capability along with the capability to open various electronic attachments in Microsoft, Adobe Acrobat, and other similar formats. Within 10 days after contract award, the Contractor shall provide the Contracting Officer a single (only one) e-mail address for electronic communications from the Contracting Officer related to this contract including, but not limited to contract documents, invoice information, request for proposals, and other correspondence. The Contracting Officer may also use email to notify the Contractor of base access conditions when emergency conditions warrant, such as hurricanes, terrorist threats, etc. Multiple email addresses will NOT be allowed.

It is the Contractor's responsibility to make timely distribution of all Contracting Officer initiated e-mail with its own organization including field office(s). The Contractor shall promptly notify the Contracting Officer, in writing, of any changes to this email address.

#### PART 2 PRODUCTS

Not Used

#### PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 32 01.00 10

PROJECT SCHEDULE  
08/08

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.

U.S. ARMY CORPS OF ENGINEERS (USACE)

ECB 2005-10 (2005) Scheduling Requirements for Testing  
of Mechanical Systems in Construction  
Contracts

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Project Schedule; G

1.3 QUALITY ASSURANCE

Designate an authorized representative to be responsible for the preparation of the schedule and all required updating (activity status) and preparation of reports. The authorized representative shall be experienced in scheduling projects similar in nature and complexity to this project and shall be experienced in the use of the scheduling software that meets the requirements of this specification.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Prepare for approval a Project Schedule, as specified herein, pursuant to the Contract Clause, SCHEDULE FOR CONSTRUCTION CONTRACTS. Show in the schedule the sequence in which the Contractor proposes to perform the work and dates on which the Contractor contemplates starting and completing all schedule activities. The scheduling of construction is the responsibility of the Contractor. Contractor management personnel shall actively participate in its development. Subcontractors and suppliers working on the project shall also contribute in developing and maintaining an accurate Project Schedule. Provide a schedule that is a forward planning as well as a project monitoring tool.

### 3.1.1 Approved Project Schedule

Use the approved Project Schedule to measure the progress of the work and to aid in evaluating time extensions. The schedule shall be cost loaded and activity coded. The schedule will provide the basis for all progress payments. The project schedule shall be capable of showing percent complete for each activity.

### 3.1.2 Schedule Status Reports

Provide a Schedule Status Report on at least a monthly basis. If the Contracting Officer determines that the Contractor has fallen behind the approved schedule, the Contracting Officer may require the Contractor to take steps necessary to improve its progress without additional cost to the Government.

## 3.2 PROJECT SCHEDULE DETAILED REQUIREMENTS

The computer software system utilized to produce and update the Project Schedule shall be capable of meeting all requirements of this specification.

### 3.2.1 Level of Detail Required

Develop the Project Schedule to an appropriate level of detail. Failure to develop the Project Schedule to an appropriate level of detail, as determined by the Contracting Officer, will result in its disapproval. The Contracting Officer will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

#### 3.2.1.1 PROGRESS SCHEDULE REQUIREMENTS

The Contractor shall prepare and submit to the Contracting Officer for approval a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the major salient features of the work, including acquiring materials and equipment. The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. The Contractor shall:

- a. Submit the progress chart in one reproducible formate and three copies to the Contracting Officer for approval no later than 15 days after notice to proceed.
- b. Prepare the progress chart in the form of a bar chart utilizing a form "Construction Progress Chart" or comparable format acceptable to the Contracting Officer.
- c. Include no less than the following information on the progress chart:
  1. Break out by major headings for each primary work activity.
  2. A line item break-out under each major heading sufficient to track the progress of the work.
  3. A line item showing contract finalization tasks which include punch list, clean-up, O&M data, and As-Built drawings. These activities are to show no associated costs.

4. The estimated percentage weight of total contract value for each line item on the chart. This shall be consistent with the Schedule of Values.

5. Separate line items for submittal preparation and reviews. These shall be consistent with the "Schedule of Submittals" required in Section 01 45 00.10 40, "DRYDEN CONSTRUCTION CONTRACTOR QUALITY CONTROL". Submittal preparation and reviews are to show no associated costs.

6. Separate line items for mobilization and demobilization.

d. Update the progress schedule in 3 copies every 30 days throughout the contract performance period. The updated schedule shall be submitted with the monthly payment request.

#### 3.2.1.2 Activity Durations

Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Less than 2 percent of all non-procurement activities shall have durations greater than 20 work days or 30 calendar days. Procurement activities are defined herein.

#### 3.2.1.3 Procurement Activities

The schedule must include activities associated with the submittal, approval, procurement, fabrication and delivery of long lead materials, equipment, fabricated assemblies and supplies. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days. A typical procurement sequence includes the string of activities: submit, approve, procure, fabricate, and deliver.

#### 3.2.1.4 Mandatory Tasks

The following tasks must be included and properly scheduled if in scope:

- b. Submission of mechanical/electrical/information systems layout drawings.
- c. Submission and approval of O & M manuals.
- d. Submission and approval of as-built drawings.
- e. Submission and approval of NASA Form NF1046 "Transfer and/or Notification of Acceptance of Accountability of Real Property" data and installed equipment lists.
- f. Submission and approval of testing and air balance (TAB).
- g. Submission of TAB specialist design review report.
- h. Submission and approval of fire protection specialist.
- i. Submission and approval of testing and balancing of HVAC plus commissioning plans and data. Develop the schedule logic associated with testing and commissioning of mechanical systems to a level of detail consistent with ECB 2005-10.

- j. Air and water balancing.
- k. HVAC commissioning.
- l. Controls testing plan submission.
- m. Controls testing.
- n. Performance Verification testing.
- o. Other systems testing, if required.
- p. Final inspection.

#### 3.2.1.5 Government Activities

Show Government and other agency activities that could impact progress. These activities include, but are not limited to: approvals, inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

#### 3.2.2 Scheduled Project Completion and Activity Calendars

The schedule interval shall extend from NTP date to the required contract completion date. The contract completion activity (End Project) shall finish based on the required contract duration in the accepted contract proposal, as adjusted for any approved contract time extensions. The first scheduled work period shall be the day after NTP is received by the Contractor. Schedule activities on a calendar to which the activity logically belongs. Activities may be assigned to a 7-day calendar when the contract assigns calendar day durations for the activity such as a Government Acceptance activity. If the Contractor intends to perform physical work less than seven days per week, schedule the associated activities on a calendar with non-work periods identified including weekends and holidays. Note as Weather Sensitive Installation those activities that are weather sensitive. Durations must account for anticipated normal adverse weather. The Government will interpret all work periods not identified as non-work periods on each calendar as meaning the Contractor intends to perform work during those periods.

##### 3.2.2.1 Project Start Date

The schedule shall start no earlier than the date on which the NTP was acknowledged. Include as the first activity in the project schedule an activity called "Start Project" (or NTP) with a start date equal to the date that the NTP was acknowledged, and a zero day duration.

##### 3.2.2.2 Schedule Constraints and Open Ended Logic

Constrain completion of the last activity in the schedule by the contract completion date. Schedule calculations shall result in a negative float when the calculated early finish date of the last activity is later than the contract completion date. Include as the last activity in the project schedule an activity called "End Project" with an end date equal to the contract completion date for the project, and with a zero day duration. The schedule shall have no constrained dates other than those specified in the contract.

### 3.2.2.3 Early Project Completion

In the event the Preliminary or Initial project schedule calculates an early completion date of the last activity prior to the contract completion date, identify those activities that it intends to accelerate and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. The last activity shall have a late finish constraint equal to the contract completion date and the schedule will calculate positive float. The Government is under no obligation to accelerate activities for which it is responsible to support a proposed early contract completion.

### 3.2.3 Milestones

The schedule must include milestone activities for each significant project event including but not limited to: milestone activities for construction; foundation/substructure construction complete; superstructure construction complete; building dry-in or enclosure complete to allow the initiation of finish activities; permanent power complete; and building systems commissioning complete.

## 3.3 PROJECT SCHEDULE SUBMISSIONS

Provide the submissions as described below. The data CD, reports, and schedules required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

### 3.3.1 Initial Project Schedule Submission

Submit the Initial Project Schedule for approval within 15 calendar days after NTP. The schedule shall demonstrate a reasonable and realistic sequence of activities which represent all work through the entire contract performance period. The Initial Schedule shall be at a reasonable level of detail as determined by the Contracting Officer.

### 3.3.2 Periodic Schedule Updates

Based on the result of the meeting, specified in PERIODIC SCHEDULE UPDATE MEETINGS, submit periodic schedule updates. These submissions will enable the Contracting Officer to assess Contractor's progress. If the Contractor fails or refuses to furnish the information and project schedule data, which in the judgment of the Contracting Officer or authorized representative is necessary for verifying the Contractor's progress, the Contractor shall be deemed not to have provided an estimate upon which progress payment may be made.

### 3.3.3 Phased Construction Schedule

Include in Project Schedule submissions, and update submissions, all Construction Phase Scheduling as required in 01 11 00 SUMMARY OF WORK. Include Contractor's plan to address any issues that put the schedule at risk.

## 3.4 SUBMISSION REQUIREMENTS

Submit the following items for the Initial Schedule and every Periodic Schedule Update throughout the life of the project:

#### 3.4.1 Data CD's

Provide two sets of data CD's containing the project schedule. Each CD shall also contain all previous update schedules. File medium shall be CD. Label each CD indicating the type of schedule (Preliminary, Initial, Update), full contract number, Data Date and file name. Each schedule shall have a unique file name as determined by the Contractor.

#### 3.4.2 Narrative Report

Provide a Narrative Report with the Initial and each Periodic Update of the project schedule, as the basis of the progress payment request. The Narrative Report shall include: a description of activities along the 2 most critical paths where the total float is less than or equal to 20 work days, a description of current and anticipated problem areas or delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. The narrative report is expected to communicate to the Government, the Contractor's thorough analysis of the schedule output and its plans to compensate for any problems, either current or potential, which are revealed through that analysis. Identify and explain why any activities that, based on their planned dates, should have either started or finished during the update period but did not.

#### 3.4.3 Approved Changes Verification

Include only those project schedule changes in the schedule submission that have been previously approved by the Contracting Officer. The Narrative Report shall specifically reference, on an activity by activity basis, all changes made since the previous period and relate each change to documented, approved schedule changes.

#### 3.4.4 Schedule Reports

The format, filtering, organizing and sorting for each schedule report shall be as directed by the Contracting Officer. Typically reports shall contain: Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float, Actual Start Date, Actual Finish Date, and Percent Complete. The following lists typical reports that will be requested. One or all of these reports may be requested for each schedule submission.

##### 3.4.4.1 Activity Report

A list of all activities sorted according to activity number.

##### 3.4.4.2 Logic Report

A list of detailed predecessor and successor activities for every activity in ascending order by activity number.

##### 3.4.4.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. List activities which have the same amount of total float in ascending order of Early Start Dates. Do not show completed activities on this report.

#### 3.4.4.4 Earnings Report by Activity

A compilation of the Contractor's Total Earnings on the project from the NTP to the data date. This report shall reflect the earnings of specific activities based on the agreements made in the schedule update meeting defined herein. Provided that the Contractor has furnished a complete schedule update, this report shall serve as the basis of determining progress payments. Group activities by activity number. This report shall: sum all activities and provide a percent complete. The printed report shall contain, for each activity: the Activity Number, Activity Description, and Percent Complete (based on total contract value).

#### 3.4.5 Network Diagram

The network diagram is required for the Initial and Periodic Updates. The network diagram shall depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

##### 3.4.5.1 Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. Show the activity number, description, duration, and estimated percent complete on the diagram.

##### 3.4.5.2 Project Milestone Dates

Show dates on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

##### 3.4.5.3 Critical Path

Clearly show the critical path.

##### 3.4.5.4 Banding

Organize activities as directed to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

#### 3.5 PERIODIC SCHEDULE UPDATE MEETINGS

Conduct periodic schedule update meetings for the purposes of reviewing the Contractor's proposed out of sequence corrections, determining causes for delay, correcting logic, maintaining schedule accuracy and determining percent complete. Meetings shall occur at least monthly within five days of the proposed schedule data date and after the Contractor has updated the schedule with Government concurrence respecting actual start dates, actual finish dates, remaining durations and percent complete for each activity it intend to status. Provide a computer with the scheduling software loaded and a projector during the meeting which allows all meeting participants to view the proposed schedule update during the meeting.

##### 3.5.1 Update Submission Following Progress Meeting

Submit a complete update of the project schedule containing all approved progress, revisions, and adjustments, pursuant to paragraph SUBMISSION REQUIREMENTS not later than 4 working days after the periodic schedule

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update meeting, reflecting only those changes made during the previous update meeting.

3.5.2 Status of Activities

Update information, including Actual Start Dates (AS), Actual Finish Dates (AF), Remaining Durations (RD), and Percent Complete shall be subject to the approval of the Government prior to the meeting. As a minimum, address the following items on an activity by activity basis during each progress meeting.

3.5.2.1 Start and Finish Dates

Accurately show the status of the AS and/or AF dates for each activity currently in-progress or completed since the last update. The Government may allow an AF date to be assigned with the percent complete less than 100% to account for the value of work remaining but not restraining successor activities. Only assign AS dates when actual progress occurs on an activity.

3.5.2.2 Remaining Duration

Update the estimated RD for all incomplete activities independent of Percent Complete. Remaining Durations may exceed the activity OD or may exceed the activity's prior update RD if the Government considers the current OD or RD to be understated based on current progress, insufficient work crews actually manning the job, unrealistic OD or deficiencies that must be corrected that restrain successor activities.

3.5.2.3 Percent Complete

Update the percent complete for each activity started, based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work and which do not restrain the initiation of successor activities may be declared 100 percent complete. To allow for proper schedule management, cost load the correction of punch list from Government final inspection not less than 1 percent of the total contract value, which activity(ies) may be declared 100 percent complete upon completion and correction of all punch list work identified during Government final inspection.

3.6 WEEKLY PROGRESS MEETINGS

a. Meet weekly with the Government (or as otherwise mutually agreed to) between the meetings described in paragraph PERIODIC SCHEDULE UPDATE MEETINGS for the purpose of jointly reviewing the actual progress of the project as compared to the planned progress and to review planned activities for the upcoming two weeks. The then-current and approved schedule update shall be used for the purposes of this meeting and for the production and review of reports. The Contractor's Project Manager and the Authorized Representative of the Contracting Officer shall attend. The weekly progress meeting will address the status of RFI's, RFP's and Submittals.

b. Provide a bar chart showing Total Float and Sorted by Early Start Date, with a two week "look-ahead" schedule by filtering all schedule activities to show only current ongoing activities and activities schedule to start during the upcoming two weeks, organized by responsible party and sorted by Early Start Date.

c. The Government and the Contractor shall jointly review the reports. If it appears that activities on the longest path(s) which are currently driving the calculated completion date, are not progressing satisfactorily and therefore could jeopardize timely project completion, corrective action must be taken immediately.

3.7 OWNERSHIP OF FLOAT

Float available in the schedule, at any time, shall not be considered for the exclusive use of either the Government or the Contractor.

-- End of Section --

SECTION 01 33 00

SUBMITTAL PROCEDURES

06/10

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by Submittal Description (SD) numbers and titles as follows:

SD-01 Preconstruction Submittals

Submittals which are required prior to the start of construction work on-site, such as:

List of proposed products

Construction Progress Schedule

Network Analysis Schedule (NAS)

Submittal register

Schedule of Values

Accident Prevention Plan

Activity Hazard Analysis for Mobilization

Quality Control (QC) plan

Environmental protection plan

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

#### SD-04 Samples

Fabricated or un-fabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

#### SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

#### SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accordance with specified requirements.

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports.

Daily logs and checklists.

Final acceptance test and operational test procedure.

#### SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel

qualifications.

#### SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and (MSDS) concerning impedances, hazards and safety precautions.

#### SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation must be signed by an authorized official of a testing laboratory or agency and must state the test results; and indicate whether the material, product, or system has passed or failed the test.

#### SD-10 Operation and Maintenance Data

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel, including manufacturer's help and product line documentation necessary to operate and maintain equipment. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

This data is intended to be incorporated in an operations and maintenance manual, database, or control system.

#### SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Special requirements necessary to properly close out a construction contract. For example, Record Drawings, warranty certificates, training records, asset / equipment list with cost breakdown, and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

##### 1.1.2 Approving Authority

Office or designated person authorized to approve submittal.

##### 1.1.3 Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

#### 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor QC approval.

Submit the following in accordance with this section.

SD-01 Preconstruction Submittals

Updated Submittal Register; G

1.3 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.3.1 Contractor QC Approved (Submittals without a "G" designation)

Contractor shall review all construction submittals for quality control. When Government approval is not required, Contractor shall be held responsible for submittal approval and construction per contract documents.

1.3.2 Government Approved (Submittals with a "G" designation)

Government approval is required for critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Government approval is required for any deviations from the Solicitation or Accepted Proposal and other items as designated by the Contracting Officer.

1.5 PREPARATION

1.5.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels to the Contracting Officer. Transmit submittals with transmittal form prescribed by Contracting Officer and standard for project. On the transmittal form identify Contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph entitled, "Identifying Submittals," of this section.

1.5.2 Identifying Submittals

When submittals are provided by a Subcontractor, the Prime Contractor is to prepare, review, and stamp with Contractor's approval all specified submittals prior to submitting for Government approval.

Identify submittals, except sample installations and sample panels, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

- a. Project title and location.
- b. Construction contract number.
- c. Date of the drawings and revisions.
- d. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other subcontractor associated with the submittal.
- e. Section number of the specification section and applicable drawing numbers by which submittal is required.

- f. Submittal description (SD) number of each component of submittal.
- g. When a resubmission, add alphabetic suffix on submittal description, for example, submittal 18 would become 18A, to indicate resubmission.

#### 1.4.2.1 Digital Submittals

In addition to providing the required quantity of hard copies of administrative, informational, material, O&M, and as-built drawing submittals, the contractor shall also include one electronic copy of each submittal. The electronic copy shall be in PDF format and submitted on non-rewritable optical media (CD or DVD) at the same time as the hard copy submittal. If material is copyrighted, written permission from the copyright holder for digital replication of O&M Manuals shall also be included. Red-lined as-built drawings shall be scanned to PDF in the same paper size as the original. Multiple submittals may be contained on a single CD.

#### 1.5.3 Format for SD-02 Shop Drawings

Shop drawings are not to be less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless other form is required. Drawings are to be suitable for reproduction and be of a quality to produce clear, distinct lines and letters with dark lines on a white background.

Present A4 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.

Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph entitled, "Identifying Submittals," of this section.

Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location adjacent to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

Include the nameplate data, size and capacity on drawings. Also include applicable federal, military, industry and technical society publication references.

#### 1.5.4 Format of SD-03 Product Data and SD-08 Manufacturer's Instructions

Present product data submittals for each section as a complete, bound volume. Include table of contents, listing page and catalog item numbers for product data.

Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.

Supplement product data with material prepared for project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for project, with information and format as required for submission of SD-07 Certificates.

Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry and technical society publication references. Should manufacturer's data require supplemental information for clarification, submit as specified for SD-07 Certificates.

Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), and Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal and marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of construction effort.

Submit manufacturer's instructions prior to installation.

#### 1.5.5 Format of SD-04 Samples

Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:

- a. Sample of Equipment or Device: Full size.
- b. Sample of Materials Less Than 2 by 3 inches: Built up to A4 8 1/2 by 11 inches.
- c. Sample of Materials Exceeding A4 8 1/2 by 11 inches: Cut down to A4 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.
- d. Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.
- e. Sample of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.
- f. Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes

and quantities of samples are to represent their respective standard unit.

g. Sample Panel: 4 by 4 feet.

h. Sample Installation: 100 square feet.

Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at time of use.

Recording of Sample Installation: Note and preserve the notation of area constituting sample installation but remove notation at final cleanup of project.

When color, texture or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

#### 1.5.6 Format of SD-05 Design Data and SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inches paper. Provide a bound volume for submittals containing numerous pages.

#### 1.5.7 Format of SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Provide reports on 8 1/2 by 11 inches paper in a complete bound volume.

Indicate by prominent notation, each report in the submittal. Indicate specification number and paragraph number to which it pertains.

#### 1.5.8 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements as specified in each section.

#### 1.5.8 Format of SD-11 As-Built Drawings

Comply with the requirements as specified in each section.

### 1.6 QUANTITY OF SUBMITTALS

#### 1.6.1 Number of Copies of SD-02 Shop Drawings

Submit three (3) copies of submittals of shop drawings requiring review and approval by Contracting Officer.

#### 1.6.2 Number of Copies of SD-03 Product Data and SD-08 Manufacturer's Instructions

Submit in compliance with quantity requirements specified for shop drawings.

1.6.3 Number of Samples SD-04 Samples

- a. Submit two samples, or two sets of samples showing range of variation, of each required item. One approved sample or set of samples will be retained by approving authority and one will be returned to Contractor.
- b. Submit one sample panel or provide one sample installation where directed. Include components listed in technical section or as directed.
- c. Submit one sample installation, where directed.
- d. Submit one sample of non-solid materials, where directed.

1.6.4 Number of Copies SD-05 Design Data and SD-07 Certificates

Submit in compliance with quantity requirements specified for shop drawings.

1.6.5 Number of Copies SD-06 Test Reports and SD-09 Manufacturer's Field Reports

Submit in compliance with quantity and quality requirements specified for shop drawings other than field test results that will be submitted with QC reports.

1.6.6 Number of Copies of SD-10 Operation and Maintenance Data

Submit three copies of O&M Data to the Contracting Officer for review and approval.

1.6.7 Number of Copies of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

Unless otherwise specified, submit three sets of administrative submittals.

1.8 VARIATIONS

Variations from contract requirements require Government approval pursuant to contract Clause FAR 52.236-21 titled, "Specifications and Drawings for Construction," and will be considered where advantageous to the Government.

An approved submittal does not relieve the contractor of the obligation to comply with contract drawings, specifications, and governing codes. Specifically point out variations from contract requirements in transmittal letters. Failure to point out deviations may result in the Government requiring rejection and removal of such work at no additional cost to the Government.

1.8.1 Considering Variations

Discussion with Contracting Officer prior to submission will help ensure functional and quality requirements are met and minimize rejections and re-submittals. When contemplating a variation which results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

1.8.2 Proposing Variations

When proposing variation, deliver written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government, including the written analysis. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

#### 1.8.3 Warranting That Variations Are Compatible

When delivering a variation for approval, Contractor, including the Contractor's Designer of Record, warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

#### 1.8.4 Review Schedule Is Modified

In addition to normal submittal review period, the Government will be allowed a period of 30 working days to consider submittals with variations.

#### 1.9 UPDATED SUBMITTAL REGISTER

The Contractor shall prepare and maintain submittal register, as the work progresses. The submittal register must have the following columns, as a minimum:

Specification Section in which submittal is required.

Submittal Description (SD No. and type, e.g. SD-02 Shop Drawings) required in each specification section.

Principal Paragraph Number, in specification section where a material or product is specified.

Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the Government.

##### 1.9.1 Use of Submittal Register

Submit Submittal Register with QC plan and project schedule. Verify that all submittals required for project are listed and add missing submittals. Coordinate and complete the following fields on the register submitted with the QC plan and the project schedule:

Activity number from the project schedule.

Scheduled date for approving authority to receive submittals.

Date Contractor needs approval of submittal.

Date that Contractor needs material delivered to Contractor control.

#### 1.10 SCHEDULING

Within 30 calendar days of notice to proceed, provide, for approval by the

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Contracting Officer, a schedule of all submittals required by the specifications and drawings. Indicate the specification or drawing reference requiring the submittal, the material, item, or process for which the submittal is required, the "SD" number and identifying title of the submittal, the Contractor's anticipated submission date and the approval need date.

Schedule and submit concurrently submittals covering component items forming a system or items that are interrelated. Include certifications to be submitted with the pertinent drawings at the same time. No delay damages or time extensions will be allowed for time lost in late submittals.

- a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential resubmittal of requirements.
- b. Submittals called for by the contract documents will be listed on the register.
- c. Re-submit register and annotate monthly by the Contractor with actual submission and approval dates. When all items on the register have been fully approved, no further re-submittal is required.
- d. Carefully control procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

1.11 GOVERNMENT APPROVING AUTHORITY

When the approving authority is the Contracting Officer, the Government will return submittals with review notations as described herein.

1.11.1 Review Notations

Contracting Officer review will be completed within 15 working days after date of submission. Submittals will be returned to the Contractor with the following notations:

- a. Submittals marked "approved" authorize the Contractor to proceed with the work covered.
- b. Submittals marked "approved as noted" authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections.
- c. Submittals marked "return for correction" or "not approved," indicate noncompliance with the contract requirements or design concept, or the submittal is incomplete. Resubmit with appropriate changes. No work shall proceed for this item until resubmittal is approved.

1.12 SUBMITTALS NOT APPROVED

No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.13 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals is not be construed as a complete check, and indicates only that:

Approval will not relieve the Contractor of the responsibility for any error which may exist. The Contractor shall fulfill Contractor Quality Control (CQC) requirements of this contract.

After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary. An approved submittal does not relieve the contractor of the obligation to comply with contract drawings, specifications, and governing codes.

#### 1.14 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not be construed to change or modify any contract requirements. Before submitting samples, the Contractor shall assure that the materials or equipment will be available in quantities required in the project.

Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those which may be damaged in testing, will be returned to the Contractor, at his expense, upon completion of the contract. Samples not approved will also be returned to the Contractor at its expense, if so requested.

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, and any further samples of the same brand or make of that material. Government reserves the right to disapprove any material or equipment which previously has proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. The Contractor shall replace such materials or equipment to meet contract requirements at no additional cost to the Government.

Approval of the Contractor's samples by the Contracting Officer does not relieve the Contractor of his responsibilities under the contract.

#### 1.16 PROGRESS SCHEDULE

##### 1.16.1 Bar Chart

- a. Submit the progress chart, for approval by the Contracting Officer, at the Preconstruction Conference in one reproducible format and three (3) copies.
- b. Submit the progress chart in one reproducible format and three (3) copies to the Contracting Officer for approval no later than 15 days after Notice to Proceed.
- c. Prepare the progress chart in the form of a bar chart utilizing form "Construction Progress Chart" or comparable format acceptable to the

Contracting Officer.

d. Include no less than the following information on the progress chart:

- (1) Break out by major headings for each primary work activity.
- (2) A line item break-out under each major heading sufficient to track the progress of the work.
- (3) A line item showing contract finalization tasks, which include punch list, clean-up, O&M Data, demolition, and As-Built drawings. These activities are to show no associated costs.
- (4) The estimated percentage weight of total contract value for each line item on the chart. This shall be consistent with the Schedule of Values.
- (5) Separate line items for submittal preparation and reviews. These shall be consistent with the "Schedule of Submittals" required in Section 01 45 00.10 40, "DRYDEN CONSTRUCTION CONTRACTOR QUALITY CONTROL". These activities are to show no associated costs.
- (6) Separate line items for mobilization and demobilization.

e. Update the progress schedule in one reproducible format and three (3) copies every 30 calendar days throughout the contract performance period. The updated schedule shall be submitted with the monthly payment request.

#### 1.17 STATUS REPORT ON MATERIAL ORDERS

Within 30 calendar days after notice to proceed, the Contractor shall submit, for approval by the Contracting Officer, an initial material status report on all material orders. This report will be updated and re-submitted every 14 calendar days as the status on material orders changes.

Report to include list, in chronological order by need date, material orders necessary for completion of the contract. The following information will be required for each material order listed:

- a. Material name, supplier, and invoice number.
- b. Bar chart line item or Definable Feature of Work (DFOW) affected by the order.
- c. Delivery date needed to allow directly and indirectly related work to be completed within the contract performance period.
- d. Current delivery date agreed on by supplier.
- e. When item d exceeds item c, the effect that delayed delivery date will have on contract completion date.
- f. When item d exceeds item c, a summary of efforts made by the Contractor to expedite the delayed delivery date to bring it in line with the needed delivery date, including efforts made to place the order (or

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subcontract) with other suppliers.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

# SUBMITTAL REGISTER

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE		DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	
		01 14 00	SD-01 Preconstruction Submittals															
			List of Contact Personnel	1.2.1.2	G													
		01 20 00.00 20	SD-01 Preconstruction Submittals															
			Schedule of Values	1.2	G													
			SD-11 Closeout Submittals															
			Contractor's Invoice	1.3														
		01 30 00	SD-01 Preconstruction Submittals															
			Electronic Mail (E-Mail) Address	1.7														
			View location map	1.2	G													
			Progress and completion pictures	1.3	G													
		01 32 01.00 10	SD-01 Preconstruction Submittals															
			Project Schedule	3.3	G													
		01 33 00	SD-01 Preconstruction Submittals															
			Updated Submittal Register	1.7	G													
		01 35 14.11 40	SD-01 Preconstruction Submittals															
			Contractor's Accident Prevention Plan	1.8.1	G													
			Activity Hazard Analysis	1.9.1	G													
			Request for Excavation and Digging Permit	1.17.1	G													
			Request for Confined Space Entry Permit	1.28	G													
			Request for Utility Outage/Facility Closure Permit	1.17.3	G													
			Request for Crane Operation Permit	1.17.4	G													

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 35 14.11 40	Request for Open Flame and Hotwork Permit	1.17.2	G												
			SD-06 Test Reports														
			Gas Protection	1.23													
			SD-07 Certificates														
			Contractor's Accident Prevention Plan	1.8.1													
			Protection Plan	1.8.2													
			License Certificates	1.20													
			Safety Meeting/Safety Inspection sheets	1.12.2													
			Safety Meeting Attendance sheets	1.12.2													
			SD-08 Manufacturer's Instructions														
			Material Safety Data Sheets	1.9.2	G												
		01 35 40.00 20	SD-01 Preconstruction Submittals														
			Environmental Protection Plan	1.8	G												
			Instructor Qualifications	1.9.1													
			SD-06 Test Reports														
			Field Quality Control Reports	3.2													
			SD-07 Certificates														
			Environmental Regulatory Requirements	1.6													
			SD-08 Manufacturer's Instructions														
			Material Safety Data Sheets	1.7.1													
			SD-11 Closeout Submittals														

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE			DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 35 40.00 20	Protection of Natural Resources	3.1													
			Contractor's NPDES/SWPPP	3.1.2													
		01 45 00.10 40	SD-01 Preconstruction Submittals														
			QC Plan	1.6	G												
		01 50 00	SD-01 Preconstruction Submittals														
			Construction site plan	1.4	G												
			Traffic control plan	3.3.1	G												
			SD-06 Test Reports														
			Backflow Preventer Tests	1.5.3													
			SD-07 Certificates														
			Backflow Tester	1.5.1													
			Backflow Preventers	1.5													
		01 74 19	SD-01 Preconstruction Submittals														
			Waste Management Plan	1.6	G												
			SD-11 Closeout Submittals														
			Records	1.7													
			Salvage Material Records	1.8													
		01 75 00.00 40	SD-01 Preconstruction Submittals														
			Verification of Prior Experience	1.2.1	G												
			Documentation of Manufacturer's Prior Experience	1.2.1	G												
			Quality Control Plan	1.2.1	G												
			Manufacturer's Sample Warranty	1.2.1													
			Operation and Maintenance Data	1.2.1	G												
			Operation and Maintenance Data	1.2.3	G												
			Provide Evidence	1.2.1													

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 75 00.00 40	SD-02 Shop Drawings														
			Drawings, Diagrams and Schedules	1.2.2	G												
			Diagrams and Instructions	1.2.2	G												
			Drawings	1.2.2	G												
			SD-03 Product Data														
			Catalog cuts	1.2.3	G												
			Samples of warranty language	1.2.3	G												
			SD-05 Design Data														
			Design Calculations	1.2.3	G												
			SD-06 Test Reports														
			Factory Tests	1.2.4.2	G												
			Functional Field Test	1.2.4.3	G												
			Final Acceptance Test	1.2.4.4	G												
			Test Procedures	1.2.4.5	G												
			SD-07 Certificates														
			Qualification of Manufacturer	1.2.1	G												
			Qualification of Installer	1.2.1													
			SD-08 Manufacturer's Instructions														
			Manufacturer's Administrative Requirements	1.2.1	G												
			Demonstration and Training Information	1.2.1	G												
			Manufacturer's Procedural Requirements	1.2.1	G												

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		MAILED TO CONTR/ DATE RCD FRM APPR AUTH
		01 75 00.00 40	SD-09 Manufacturer's Field Reports														
			Documentation of the Testing and Verification Actions	1.2.4.3	G												
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance Data	1.2.1													
			Operation and Maintenance Data	1.2.3													
			Safety and Security Data or Posters	1.2.3													
		01 78 00	SD-03 Product Data														
			As-Built Record of Equipment and Materials	1.3.2													
			Warranty Management Plan	1.7.1													
			Warranty Tags	1.7.4													
			Final Cleaning	1.9													
			Spare Parts Data	1.4													
			SD-08 Manufacturer's Instructions														
			Preventive Maintenance	1.5													
			Condition Monitoring (Predictive Testing)	1.5													
			Inspection	1.5													
			Instructions to be Posted	1.7.1													
			SD-10 Operation and Maintenance Data														

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 78 00	Operation and Maintenance Manuals	1.8													
			SD-11 Closeout Submittals														
			As-Built Drawings	1.3.1													
			Certification of EPA Designated Items	1.6	G												
			NASA Form NF1046	1.10													
		02 41 00	SD-07 Certificates														
			Notifications	1.4.1	G												
			Demolition plan	1.9	G												
			SD-11 Closeout Submittals														
			Receipts	1.4.2													
		03 30 00	SD-02 Shop Drawings														
			Formwork	1.6.2.1													
			Formwork	1.6.2.1													
			Reinforcing steel	1.6.2.2	G												
			SD-03 Product Data														
			Materials for curing concrete	2.4.6	G												
			Joint sealants	2.4.8	G												
			Joint filler	2.4.7	G												
			Reinforcement	2.5	G												
			Cement	2.4.1	G												
			Recycled Aggregate Materials	2.4.3.1	G												
			Epoxy bonding compound	2.4.9	G												
			Bonding materials	2.6	G												
			Ready-Mix Concrete	2.3.2	G												

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																		(a)
		03 30 00	Curing Concrete Elements	1.6.3.1	G													
			Local/Regional Materials	1.8.1	G													
			Biodegradable Form Release Agent	2.4.10	G													
			SD-05 Design Data mix design	2.3.1	G													
			SD-06 Test Reports Concrete mix design	1.6.4.1	G													
			Fly ash	1.6.4.2														
			Pozzolan	1.6.4.2														
			Ground granulated blast-furnace slag	1.6.4.3														
			Aggregates	1.6.4.4														
			Compressive strength tests	3.12.2.3														
			Slump	2.7.4														
			Air Content	3.12.2.4														
			Curing Concrete Elements	1.6.3.1														
			SD-07 Certificates Pumping concrete	1.6.3.2														
			Biodegradable Form Release Agent	2.4.10														
			VOC Content for form release agents, curing compounds, and concrete penetrating sealers	1.6.3.4														
			Material Safety Data Sheets	1.6.3.5														

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ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		03 30 00	Forest Stewardship Council (FSC) Certification	1.8.2													
			SD-08 Manufacturer's Instructions														
			Fly ash	1.6.4.2													
			Ground granulated blast-furnace slag	1.6.4.3													
			Steel Bar	2.5.5													
		05 50 13	SD-02 Shop Drawings														
			Angles and plates	2.4	G												
			Guard posts (bollards/pipe guards)	2.3	G												
		26 05 00.00 40	SD-03 Product Data														
			Conduits, Raceway and Fittings	3.1	G												
			Wire and Cable	2.2	G												
			Splices and Connectors	2.3	G												
			Pull Boxes	2.4	G												
			Circuit Breakers	2.5	G												
			Spare Parts	1.4													
			SD-06 Test Reports														
			Continuity Test	3.4													
			SD-08 Manufacturer's Instructions														
			Manufacturer's Instructions	1.5													
		28 31 76	SD-02 Shop Drawings														
			Wiring Diagrams	3.1.1	G												
			System Layout	1.4.1	G												
			System Operation	2.3	G												

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE		DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		28 31 76	Notification Appliances	2.15	G												
			Amplifiers	2.13	G												
			As-Built Drawings	3.5.2													
			SD-03 Product Data														
			Technical Data And Computer Software	1.4.2	G												
			Fire Alarm Control Panel (FACP)	1.4.2	G												
			Fire Alarm Control Panel (FACP)	2.11	G												
			Terminal cabinets	3.1.2	G												
			Manual stations	2.14	G												
			Batteries	2.10.1	G												
			Battery chargers	2.10.2	G												
			Smoke sensors	2.8	G												
			Thermal sensors	2.9	G												
			Wiring	3.1	G												
			Notification appliances	2.15	G												
			Addressable interface devices	2.6	G												
			Graphic annunciator	2.3.2	G												
			Amplifiers	2.13	G												
			Tone generators	2.13	G												
			Digitalized voice generators	2.13	G												
			Waterflow detectors	2.18	G												
			Tamper switches	2.17	G												
			Remote fire alarm control units	2.12	G												
			SD-05 Design Data														
			System Operation	2.3	G												

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		28 31 76	Battery power	2.10.1.2	G												
			SD-06 Test Reports														
			Field Quality Control	3.5													
			Testing Procedures	3.5.1	G												
			Smoke sensor testing	2.8.2	G												
			SD-07 Certificates														
			Installer	1.6.1.4													
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance (O&M) Instructions	1.8	G												
			Instruction of Government Employees	3.6													
		31 23 00.00 20	SD-01 Preconstruction Submittals														
			Shoring and Sheeting Plan	1.7.1	G												
			Dewatering work plan	1.7.2	G												
			AGGREGATES	2.3	G												
			SD-06 Test Reports														
			Fill and backfill	3.12.2.1													
			Density tests	3.12.2.2													
			Moisture Content Tests	3.12.2.3													
		33 11 00	SD-03 Product Data														
			Piping Materials	2.1.1													
			Water distribution main	2.1	G												
			Water service line	2.2	G												

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		33 11 00	Reduced pressure principle backflow preventer assemblies	2.3	G												
			Valve boxes	2.1.2.5	G												
			Valve boxes	2.2.2.8	G												
			Service saddle	2.2.2.10	G												
			Tapping sleeves	2.2.2.9	G												
			Insulation	2.2.2.11	G												
			Bolted Steel Reservoir Tank	1.2.3													
			Relining Product Data	2.4.2	G												
			SD-06 Test Reports														
			Disinfection	3.1.5	G												
			SD-07 Certificates														
			Water distribution main	2.1													
			Water service line	2.2													
			Reduced pressure principle backflow preventer assemblies	2.3													
			SD-08 Manufacturer's Instructions														
			Delivery, storage, and handling	1.4													
			Installation	3.1.1													
			SD-11 Closeout Submittals														
			GIS Record Of Survey Data	1.5													

SECTION 01 35 14.11 40

DRYDEN SAFETY REQUIREMENTS

07/07

PART 1 GENERAL

1.1 SUMMARY

The requirements of this Section apply to, and are a component part of, each section of the specifications.

1.2 NASA's Commitment to Safety

The success of this historic agency starts with an unwavering commitment to safety. The culture of this institution is one of safe accomplishment of our missions, including construction projects. If something about this project, or any task, is unclear, it is required that you, the Contractor, ask for clarification. No activities on this project, or at this Agency, are important enough to compromise the safety of any person. If you suspect something isn't quite right, trust your instincts and your experience, and do something to correct the situation.

NASA's mission success starts with safety. A commitment to safety permeates everything we do. We are committed to protecting the safety and health of the general public, pilots and astronauts, the NASA workforce, and our high-value assets on and off the ground.

1.3 The Dryden Safety Culture

Safety at the Dryden Flight Research Center is of paramount concern. We assure a commitment to safety by employing systems and processes that ensure the safety of the public, the employees, and assets. We ensure safety in all aspects of personal endeavors and we are committed to ensuring the safety of others. We take ownership for safety. We know every accident is preventable. In the spirit of the Dryden Flight Research Center, the Contractor shall implement the safety provisions of this section to "make known the overlooked and unexpected" to keep all employees safe. The Contractor shall INSTRUCT ALL EMPLOYEES as to the hazards and the precautions to be taken in performance of this contract. The Contractor shall provide and maintain work environments and procedures which will safeguard Contractor employees, Subcontractors, the Public, Government personnel, and Government property, materials, supplies, and equipment exposed to Contractor operations and activities.

1.4 Construction Safety Goals

The safety provisions of this section are to be implemented by the Contractor so that:

- a. Everyone involved in this project goes home as healthy as they arrived.
- b. This construction work site is free of recognizable hazards.
- c. We have zero lost-time accidents.
- d. We have zero injuries in our workplace.

### 1.5 Construction Safety Strategy

In order to meet these goals every individual working onsite for the Contractor, including Subcontractors, Vendors and their employees, shall:

- a. Be involved in making this project safer.
- b. Know how to identify hazards.
- c. Know how to report hazards and get them fixed.
- d. Know their safety and health training needs, have obtained that training, and shall put the concepts to work each and every day while working on this project.

### 1.6 Compliance

The Contractor shall take safety and health measures in performing work under this Contract. The Contractor shall comply with all applicable federal, NASA/Dryden Flight Research Center (DFRC), and Edwards Air Force Base occupational safety and health requirements and standards. The Contractor shall take all precautions in the performance of work under this contract to protect the safety and health of the Contractor's employees, to protect the safety and health of all persons in or near the jobsite, and to prevent damage to property, materials, supplies and equipment. The Contractor shall comply with Federal OSHA Safety and Health Standards 29 CFR 1910 and 29 CFR 1926. The Contractor shall comply with the U.S. Army Corps of Engineers Safety and Health Requirements Manual in effect on the date of the solicitation.

### 1.7 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.

#### NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA NPG 8621.1	(2004a) NASA Mishap Reporting, Investigating and Record Keeping Policy
NASA NPG 8715.3	(2004) NASA Safety Manual
NASA NSS 1740.12	(1993) NASA Safety Standard For Explosives, Propellants and Pyrotechnics
NASA STD 8719.11	(2000) NASA Safety Standard for Fire Protection

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

10 CFR 20	Standards for Protection Against Radiation
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction

1.8 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

The following items shall be submitted in accordance with Paragraphs 1.8.1 "Contractor's Accident Prevention Plan" and 1.9.1 "Activity Hazard Analysis" of this section. (See also Paragraph 1.10.1 "Documents at the Jobsite" of this section).

Contractor's Accident Prevention Plan; G  
Activity Hazard Analysis; G

The following Requests for Permit shall be submitted in accordance with Paragraph 1.17 "PERMIT REQUIRED OPERATIONS" of this section.

Request for Excavation and Digging Permit; G  
Request for Confined Space Entry Permit; G  
Request for Utility Outage/Facility Closure Permit; G  
Request for Crane Operation Permit; G  
Request for Open Flame and Hotwork Permit; G

SD-06 Test Reports

Records shall be submitted in accordance with paragraph entitled, "Gas Protection," of this section.

SD-07 Certificates

Statements shall be submitted for the following items in accordance with paragraphs entitled, "Contractor's Accident Prevention Plan" and "Protection Plan," of this section.

Contractor's Accident Prevention Plan

Protection Plan

License Certificates

The following shall be submitted with the Contractor's "Daily Report to the Inspector" by 10:00 am the next work day in accordance with Paragraph 1.12.2 "Daily Safety Meetings/Daily Safety Inspections" of this section:

Safety Meeting/Safety Inspection sheets

Safety Meeting Attendance sheets

Confined Space Entry Training Certificates shall be submitted for all Confined Space Entry Attendants/Entry Supervisors prior to any employees entering a confined space. (See also Paragraph 1.10.1 "Documents at the Jobsite" of this section.

SD-08 Manufacturer's Instructions

Material Safety Data Sheets (MSDS), G

MSDSs for all chemicals and hazardous materials brought to the jobsite. MSDSs shall be submitted in accordance with Paragraph titled "Material Safety Data Sheets (MSDS)" and Paragraph Titled "Chemicals and Hazardous Materials" of this section. (See also Paragraph Titled "Documents at the Jobsite" of this section.)

1.8.1 Contractor's Accident Prevention Plan

Contractor shall submit an Accident Prevention Plan to the Contracting Officer for approval within 14 calendar days after notice to proceed and prior to start of construction at project site. The Accident Prevention Plan written by the prime Contractor for the specific work and hazards of this contract shall implement in detail the pertinent requirements of the US Army Corps of Engineers Safety and Health Requirements Manual. The plan shall define how the Contractor will comply with Federal OSHA Safety and Health Standards 29 CFR 1910 and 29 CFR 1926. Prior to initiation of work at the job site, the Contractor's Accident Prevention Plan shall be reviewed, found acceptable, and approved by the Contracting Officer.

Accident Prevention Plan shall be NASA/DFRC site specific and include, as a minimum, the following:

- a. Safety program objectives.
- b. Methods to attain safety objectives.
- c. Responsibility of key personnel for the Contractor.
- d. Safety meetings, surveys, inspections, and reports.
- e. Disaster and emergency programs as it applies to the NASA/DFRC site.
- f. Lists of key personnel to be contacted in times of emergency, along with appropriate phone numbers to be used in emergencies.
- g. Program to show compliance with Federal OSHA Safety and Health Standards 29 CFR 1910 and 29 CFR 1926 and various safety requirements of NASA NPG 8715.3.
- h. Methods to comply with the requirement for immediate reporting of mishaps to the Contracting Officer in accordance with NASA NPG 8621.1.
- i. Statement that the Contractor will not invalidate the integrity of safety systems without proper authorization.
- j. Procedures for emergency actions to be taken to secure dangerous conditions, to protect personnel, and secure work areas in the event of accident or an act of nature. This shall include procedures to secure dangerous conditions, protect personnel, and secure work areas. The plan must contain 911 telephone contact procedures specific to NASA/DFRC (See Paragraph "FIRST AID AND EMERGENCIES" of this section).
- k. Procedures for securing the mishap site so that the area remains secure until arrival of a safety investigator. Mishap site will

remain secured until released by the Contracting Officer.

- l. A map with the location and times of operation of the NASA/DFRC medical dispensary. (This information can be obtained from the Contracting Officer.)
- m. Procedures describing how chemicals, hazardous materials and hazardous wastes will be handled, managed and disposed of while at NASA/DFRC.
- n. Incorporate plans for the following, as applicable:  
Lockout/Tagout, Confined Space, Fire Prevention, Electrical Safety, and Fall Prevention/Protection.
- o. Incorporate a comprehensive site-specific heat stress monitoring plan. Drinking water shall be made available to workers and workers shall be encouraged to frequently drink small amounts; the water shall be kept reasonably cool.

#### 1.8.2 Protection Plan

Structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations shall be protected against damage.

#### 1.9 GENERAL SAFETY PROVISIONS

Contractor shall take safety and health measures in performing work under this Contract. Contractor shall meet with the Contracting Officer to develop a mutual understanding relative to administration of the Accident Prevention Plan. Contractor is subject to applicable federal, state, and local laws, regulations, ordinances, codes, and orders relating to safety and health in effect on the date of this Contract.

During the performance of work under this Contract, the Contractor shall comply with procedures prescribed for control and safety of persons visiting the project site. Contractor is responsible for his personnel and for familiarizing each of his subcontractors with safety requirements. Contractor shall advise the Contracting Officer of any special safety restriction he has established so that Government personnel can be notified of these restrictions.

##### 1.9.1 Activity Hazard Analysis

Prior to beginning each Definable Feature of Work (DFOW), an activity hazard analysis shall be prepared by the Contractor performing the work. A DFOW is defined as an operation involving a type of work presenting hazards not experienced in previous operations or where a new subcontractor or work crew is to perform. Work will not proceed on that phase until the activity hazard analysis has been accepted by the Contracting Officer and discussed with all engaged in the activity, including the Contractor, subcontractors, and government on-site representatives.

The Activity Hazard Analysis shall:

- a. define the activity to be performed and identify the sequence of work,
- b. define the specific hazards anticipated with the activity,

- c. define the control measures to be implemented to eliminate or reduce each hazard to an acceptable level,
- d. identify the equipment to be used,
- e. identify the inspection requirements for that equipment and activity, and
- f. list the training requirements for the workers.

#### 1.9.2 Material Safety Data Sheets (MSDS)

Provide the Contracting Officer with a copy of the Material Safety Data Sheets for all chemicals and hazardous materials to be brought on site. All manufacturers' recommended precautions shall be followed during the use of any chemical and hazardous material. MSDSs must be submitted to the Contracting Officer for approval prior to the use of any chemical or hazardous substance. See also Paragraph 1.10.1 "Documents at the Jobsite" and Paragraph 1.27.1 "Chemicals and Hazardous Materials" of this section.

#### 1.10 SAFETY COMMUNICATIONS

Accident Prevention Plans, hazard analyses, and MSDSs are only effective when the workers in the field are aware of the potential hazards for that day, and take mitigation measures to work safely in that area at that time. Therefore, daily safety communications are a critical requirement. Every work day shall begin with a brief safety meeting and every work day shall include a safety inspection by the Contractor's Site Safety Officer, see Paragraph Titled "Daily Safety Meetings/Daily Safety Inspections".

Also, prior to beginning any new DFOW the Contractor shall conduct an Activity Hazard Analysis on that new class of work and shall conduct a thorough discussion of that Activity Hazard Analysis with the workers performing the work. The Contractor shall ensure the workers understand the hazards and how to use any special tools, unique equipment, and personal protective equipment. Only after these safety analyses and communications occur shall the new class of work be allowed to proceed.

##### 1.10.1 Documents at the Jobsite

To help maximize safety communications, the following list of documents shall be maintained on the jobsite and made easily available for the Contractor's employees and Subcontractors' employees. These records shall also be made available for Government inspection. They include but are not limited to:

- a. the approved Accident Prevention Plan,
- b. all approved Activity Hazard Analysis,
- c. all approved MSDSs,
- d. all approved permit documents for Permit Required Operations that have been completed,
- e. all records of lockout/tagout operations that have been completed,
- f. the jobsite OSHA 300 log,

g. all training records, including Confined Space Entry Training Certificates, and

h. other records that are deemed appropriate due to the nature of the work, i.e. certificates, permits, licenses, etc.

These records shall be stored at a convenient centralized location on the jobsite. These records shall be organized, filed, and labeled in binders or file folders in a fashion that all persons involved with the project can obtain the information quickly and easily.

#### 1.10.2 Posted Warnings and Prohibitions

The Contractor shall comply with procedures prescribed for control and safety of all persons visiting the project site. The contractor shall install all barricades and signs needed. All points of entry to the project site shall have a sign warning of the requirement to wear hard hats. The Contractor is responsible for familiarizing each employee and each subcontractor employee with safety requirements.

All Contractor personnel are to obey all posted prohibitions, restrictions, warnings, and traffic control signs and devices. Contractor personnel shall not enter any area in which a red light is flashing without permission of the NASA area supervisor. When alarm bells are sounded in a building, secure the equipment in use and leave the building by the nearest exit. An egress passage must be maintained at all times in the work area. The Contractor shall advise employees of these requirements.

The Contractor shall advise the Contracting Officer of any special safety restrictions the Contractor has established so that Government personnel can be notified of these restrictions.

#### 1.10.3 Display of Safety Information

The Contractor shall erect a safety bulletin board at the job site within 2 calendar days after the Contracting Officer has approved the Accident Prevention Plan. The following information shall be displayed on the safety bulletin board in clear view of the on-site construction personnel, maintained current, and protected against the elements and unauthorized removal:

- a. Map denoting the route to the nearest emergency care facility.
- b. Emergency phone numbers.
- c. Copy of the most up-to-date Accident Prevention Plan.
- d. Current AHA(s) and MSDSs.
- e. OSHA 300A Form.
- f. OSHA Safety and Health Protection-On-The-Job Poster.
- g. Safety and Health Warning Posters.
- h. Active Permits.

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1. Excavation and Digging,
2. Open Flame and Hot Work,
3. Confined Space Entry,
4. Utility Outages/Facility Closures
5. Crane Operations.

i. Contractor is encouraged to post in a common area the number of years without a lost time construction accident at NASA's Dryden Flight Research Center.

1.10.4 TRAINING

1.10.4.1 New Employee Indoctrination

New employees (prime, subcontractor, vendors, and suppliers) onsite will be informed of specific site hazards before they begin work. Documentation of this orientation shall be kept on file at the project site.

1.10.4.2 Periodic Training

Provide Safety and Health Training in accordance with USACE EM 385-1-1 and the approved Accident Prevention Plan. Ensure all required training has been accomplished for all onsite employees.

1.10.4.3 Training on Activity Hazard Analysis (AHA)

Prior to beginning a new phase, training will be provided to all affected employees to include a review of the AHA to be implemented.

1.11 SAFETY LOCKOUT/TAGOUT PROCEDURES

Contractor shall ensure that each employee is familiar with and complies with these procedures and 29 CFR 1910.147. Specific Lockout/Tagout requirements are as follows:

- a. The tags shall be the same for both lockout and tagout, and shall only be used once. The information on the tag shall be printed legibly.
- b. For lockout the information shall include - name of person controlling the lock, the date the lock was put in place, telephone number of the person controlling the lock, name of the Project Inspector monitoring the work, name of the company serving as prime contractor for the work, and the name of the company for which the lock control person is employed.
- c. For tagout, the above information is required plus an explanation of why a lock could not be used, and what additional safety precautions were used.

The above information shall be documented, and the record made available for inspection. Upon completion of the Lockout/Tagout Operation the documents shall be stored at the jobsite.

Contracting Officer will, at the Contractor's request, apply lockout/tagout tags and take other actions that, because of experience and knowledge, are

known to be necessary to make the particular equipment safe to work on.

No person, regardless of position or authority, shall operate any switch, valve, or equipment that has an official lockout/tagout tag attached to it, nor shall such tag be removed except as provided in this section.

No person shall work on any equipment that requires a lockout/tagout tag unless he, his immediate supervisor, project leader, or a subordinate has in his possession the stubs of the required lockout/tagout tags.

Only qualified personnel shall perform work on electrical circuits.

A supervisor who is required to enter an area protected by a lockout/tagout tag will be considered a member of the protected group provided he notifies the holder of the tag stub each time he enters and departs from the protected area.

Identification markings on building light and power distribution circuits shall not be relied on for established safe work conditions.

Before clearance will be given on any equipment other than electrical (generally referred to as mechanical apparatus), the apparatus, valves, or systems shall be secured in a passive condition with the appropriate vents, pins, and locks.

Pressurized or vacuum systems shall be vented to relieve differential pressure completely.

Vent valves shall be tagged open during the course of the work.

Where dangerous gas or fluid systems are involved, or in areas where the environment may be oxygen deficient, system or areas shall be purged, ventilated, or otherwise made safe prior to entry.

#### 1.11.1 Tag Placement

Lockout/tagout tags shall be completed in accordance with the regulations printed on the back thereof and attached to any device which, if operated, could cause an unsafe condition to exist.

If more than one group is to work on any circuit or equipment, the employee in charge of each group shall have a separate set of lockout/tagout tags completed and properly attached.

When it is required that certain equipment be tagged, the Government will review the characteristics of the various systems involved that affect the safety of the operations and the work to be done; take the necessary actions, including voltage and pressure checks, grounding, and venting, to make the system and equipment safe to work on; and apply such lockout/tagout tags to those switches, valves, vents, or other mechanical devices needed to preserve the safety provided. This operation is referred to as "Providing Safety Clearance."

#### 1.11.2 Tag Removal

When any individual or group has completed its part of the work and is clear of the circuits or equipment, the supervisor, project leader, or individual for whom the equipment was tagged shall turn in his signed lockout/tagout tag stub to the Contracting Officer. That group's or

individual's lockout/tagout tags on equipment may then be removed on authorization by the Contracting Officer.

#### 1.12 SAFETY MEETINGS AND INSPECTIONS

##### 1.12.1 Mutual Understanding Meeting

Before commencing the work, the Contractor shall meet with representatives of the Contracting Officer to discuss and develop a mutual understanding relative to administration of the overall safety program. Items to be discussed shall include: COE EM-385-1-1, hard hats/safety shoes, other personal protective equipment (PPE), daily safety meetings, activity hazard analysis, frequency of inspections, 911 communications, stopping of unsafe activities, permit required operations and MSDSs.

##### 1.12.2 Daily Safety Meetings/Daily Safety Inspections

The Contractor shall conduct daily safety meetings at the beginning of each work shift. This safety meeting shall be administered by the Contractor's Site Safety Officer and/or Job Superintendent, or qualified designated representatives of these elements. This safety meeting shall be attended by all of the Contractor's employees, as well as all subcontractors and their employees working at the project site for that day. If any of these persons are not present at the daily safety meeting, they shall be briefed of the issues discussed in the meeting on an individual basis by the Contractor's Site Safety Officer prior to starting work at the site that day. The safety meeting format and discussion shall include, but not be limited to: the schedule of events on the site for the day; addressing hazard analyses for the day's activities; allowing employees and subcontractors to submit hazard analyses and MSDSs for upcoming activities; planning permit required operations; discussing unsafe conditions and near misses on the job site; discussing new equipment and material deliveries to the job site; discussing corrective actions to be taken and assignment of responsibilities for the implementation of those corrective actions.

The Contractor's designated Site Safety Officer shall, at least once per shift, conduct at least one walk-through site safety inspection of all site activities. This inspection shall be conducted at a random time during each shift. The Site Safety Officer's sole purpose during the walk-through shall be to ensure compliance with the approved Accident Prevention Plan, approved Activity Hazard Analysis, and approved MSDSs. Additionally the Site Safety Officer must ensure the workers receive feedback as to their safety effectiveness and compliance with safety procedures.

The Contractor shall use the attached Safety Meeting/Safety Inspection sheets and Safety Meeting Attendance sheets, or an approved equal, to report the elements described herein. These sheets shall be submitted to the Contracting Officer on a daily basis by 10:00 am on the next work day, (with the Contractor's "Daily Report to the Inspector").

#### 1.13 CONTRACTOR VEHICLES AND EQUIPMENT

Edwards AFB access passes for Contractor owned vehicles are included in the personnel pass and/or badging process. Proof of registration and insurance, as well as a valid driver's license, must be presented at that time.

Contractor-owned, leased, or operated equipment must be in satisfactory mechanical condition. Vehicle identification is required on both sides of all contractor vehicles, clearly identifying the contractor. While in use

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at the job site, rental equipment shall be kept in good working order and properly maintained. Contractor owned equipment brought on site must have copies of all operating air permits for the equipment.

Prior to a piece of rental equipment arriving on the job site, the Contractor shall present a hazard analysis for the use of the equipment. The hazard analysis shall include consideration for hazards associated with unloading, moving, and reloading the equipment. The Contractor is responsible to ensure that all employees working on or around that equipment are properly trained to use it and made aware of its associated hazards.

Hoisting and lifting devices and cranes must bear evidence of proof loading within the preceding 12 months. Operators of hoisting and lifting devices and cranes shall be trained in proper use and safety limitations. The Contractor shall provide written proof of qualification for all operators of fork lifts and personnel lifts (i.e. boom lifts, platform lifts, scissors lifts, etc.). Outdoor hoisting operations shall not commence if winds are above 20 knots (23 mph) steady state or if gusts exceed 35 knots (40 mph) and the Contractor shall also comply with the manufacturer's recommended operating limits; the more restrictive shall govern.

Crane operators shall meet the requirements in USACE EM 385-1-1, Section 16 and Appendix G. In addition, for mobile cranes, crane operators shall be designated as qualified by a source that qualifies crane operators (i.e., union, a government agency, or an organization that tests and qualifies crane operators). Written proof of current qualification shall be provided.

Contractor owned vehicles which will be driven on the flight line (aircraft hangars, aprons, ramps, tow-ways, and taxiways) must bear identifying signs and property damage insurance. Access to the flight line must be authorized by the Contracting Officer. The Contractor shall be responsible for performing daily inspections of these vehicles and shall secure, remove, or dispose of all foreign objects, materials, and debris that can cause damage to an aircraft. Objects and debris lodged between tire treads shall be removed prior to driving on the flight line. All vehicles which are permitted on aircraft maintenance ramps, fuel storage areas, fuel servicing areas, hangars, explosive areas, and any other fire hazard areas shall be equipped with an approved spark arrestor and authorized in writing by the Contracting Officer for use in these areas.

Operators of motor vehicles shall be licensed. Only Contractor work vehicles, delivery vehicles, and debris hauling vehicles, driven by licensed operators, will be allowed at the work site. Vehicles for transportation of personnel or personal tools (commuting) must be parked in designated parking spaces.

The use of seat belts is mandatory by all operators and passengers traveling in motor vehicles on Edwards Air Force Base and NASA/DFRC. Passengers are prohibited from riding in or on the back or bed of any truck. The speed limit, unless otherwise posted, is 15 miles per hour. The security police use radar units.

Use of Government owned equipment, tools, supplies, or materials is prohibited unless specifically authorized by the Contracting Officer.

1.13.1 VEHICLE FOREIGN OBJECT DEBRIS (FOD) PREVENTION STEPS

Cars, trucks, trailers, and mobile service vehicles that have access to

aircraft operational areas are a potential source of FOD. Prevention that should be taken includes:

- a. Regularly inspect all vehicles such as refueling trucks, supply trucks, contract vehicles, and maintenance vehicles that operate on the flight line and hangar areas for foreign objects.
- b. Before a vehicle is driven onto taxiways, runways, or into aircraft parking areas, the driver will stop and check that there are no rocks or pebbles caught in the tire treads and that the load is secure. The driver will also check pickup beds for loose tools, hardware, trash, and other debris.
- c. Vehicles must not be driven off the hard surface unless absolutely necessary. If it does become necessary to drive off to let an aircraft pass or for any other reason, the driver will once again check the load for security and the tires for foreign objects before re-entering the hard surfaced area. This does not apply to emergency vehicles responding to an emergency.
- d. All vehicles will enter and leave the flight line at controlled access points unless an emergency vehicle is responding to an emergency.

#### 1.14 ACCIDENT TREATMENT AND RECORDS

Contractor shall post emergency first aid and ambulance information at project site.

#### 1.15 FIRE PREVENTION AND PROTECTION

In addition to the requirements stated below, the Contractor shall also be familiar with guidelines located in NASA STD 8719.11 NASA Safety Standard for Fire Protection.

Open-flame heating devices will not be permitted except by approval in writing from the Contracting Officer. Approval for the use of open fires and open-flame heating devices will not relieve the Contractor from the responsibility for any damage incurred because of fires.

Burning trash, brush, or wood on the project site shall not be permitted.

Any fire hazard conditions shall be immediately reported to Contracting Officer. Any fire emergency situation shall be reported by calling 911 or the NASA/DFRC Security Post #1 at (661) 276-3256. Contractor vehicles must not block or encroach upon fire truck lanes at any time. The Contractor shall provide temporary fire protection equipment for the protection of personnel and property during construction.

All work sites shall be kept clean and orderly at all times. Combustible scrap, debris, and waste materials (oily rags, paper, packaging, scrap wood, etc.) shall be stored in covered metal receptacles and removed from the worksite daily to minimize potential hazards. Flammable and combustible materials shall be stored in a manner which minimizes the risk of fire including spontaneous combustion. "No Smoking" signs shall be posted in areas where flammable or combustible material are stored.

Only UL-approved containers and tanks shall be used for storage and handling of flammable and combustible liquid. All flammable and combustible liquids shall be kept in closed containers when not in use.

Bulk drums of flammable or combustible liquids shall be grounded and bonded to containers during dispensing. The Contractor shall provide and be equipped with one full 10 pound 4-A:60 BC multipurpose dry chemical fire extinguisher placed within 20 feet where flammable/combustible liquids are stored.

The Contractor shall ensure the following are complied with when pressurized cylinders are on the jobsite:

- a. Cylinder contents shall be identified with a label.
- b. All cylinders shall be stored in an upright position at all times.
- c. Cylinders shall be secured at all times.
- d. Cylinders not in use shall have valve protector caps in place.

Smoking is not permitted in buildings or on roofs. Smoking is permitted in approved designated areas only. Smoking materials shall be disposed in an approved receptacle.

Nonspark producing tools and equipment or pneumatic type shall be utilized in fire hazardous areas such as hangars and other explosive environment areas. Burning of trash or rubbish is prohibited.

Dispensing of flammable and combustible liquids is not permitted in buildings or on roofs.

#### 1.16 USE OF EXPLOSIVES

Explosives shall not be used or brought to the project site without written approval of the Contracting Officer.

#### 1.17 PERMIT REQUIRED OPERATIONS

The Contractor shall coordinate with the Contracting Officer and obtain written approval from the Contracting Officer on all Permit Required Operations before the operation begins. The Contractor shall initiate coordination with the Contracting Officer by writing and submitting a Request for Permit. The Contractor shall provide, with the Request for Permit the following:

- a. Work Plan - A written work plan describing the work to be accomplished during the Permit Required Operation including a schedule to be followed. The schedule shall include the dates and time period the Contractor contemplates performing the operation.
- b. Activity Hazard Analysis - An activity hazard analysis of the proposed activities during the Permit Required Operation including the Contractor's plan to minimize or eliminate any hazards associated with the performance of the work. See paragraph 1.9.1

The permits are primarily used to identify potentially hazardous work conditions in an attempt to prevent accidents. The permits are also used to coordinate the required work with key DFRC activities and keep customer inconvenience to a minimum. The permits shall be processed just prior to the start of the operation. Permit forms will be provided and filled out by the Government. The Contractor shall post approved permits at a conspicuous location in the construction area near the permitted

operation. Upon completion of the Permit Required Operation a copy of the approved permit documents shall be stored at the jobsite in accordance with Paragraph "Documents at the Jobsite" of this section. Permit required operations are:

1. Excavation and Digging
2. Open Flame and Hot Work
3. Confined Space Entry,
4. Utility Outages/Facility Closures, and
5. Crane Operations.

#### 1.17.1 Excavation and Digging

Surface penetration, excavation, digging, and trenching are Permit Required Operations. Surface penetration, excavation, digging, and trenching operations must be approved by the Contracting Officer before operations begin. The Contractor shall obtain this approval by submitting a written Request for Excavation and Digging Permit in accordance with Paragraph 1.17 "PERMIT REQUIRED OPERATIONS". The Contractor shall submit this request to the Contracting Officer seven (7) calendar days prior to the start of digging operations, to enable the Contracting Officer to review measures being taken to prevent hazard to employees and possible damage to subsurface utilities.

The permit, a NASA - DRYDEN FACILITIES ENGINEERING WORK CLEARANCE REQUEST (Dryden form DWK-808-8), must be filled out by the Government and attached to the Contractor's Request for Excavation and Digging Permit. This package must be reviewed and approved by several DFRC and USAF organizations prior to start of surface penetration, excavation, digging, or trenching. During this review and approval period the Contractor can proceed with marking and staking activities described below.

Prior to performing any surface penetrations, excavation, digging, or trenching 6 inches or deeper (including driving stakes more than 6 inches in the ground) on any ground surface, the Contractor shall obtain from the Contracting Officer the current subsurface utility drawing of the particular area to be worked on. All utility lines shall be identified and marked in the field. The Contractor shall stake out, mark, paint lines, or other wise identify all subsurface pressurized gas pipes, high voltage cables, communication cables, other pipe lines, and other subsurface structures indicated within the area of the work before any surface penetration, excavation, digging, or trenching is done. After identification is complete, the Contractor shall obtain agreement from the Contracting Officer that identification is sufficient. After obtaining the approved permit package from the Contracting Officer and completing the marking and staking activities, the Contractor shall proceed with the excavating and digging operation in accordance with the approved permit documents.

The Contractor, however, shall temporarily halt any powered equipment digging and machine excavation work (i.e. backhoe, jackhammer, trencher, auger, etc.) when approaching within 10 feet of the staked-out/marked utility until the Contractor has exposed the utility by hand excavation to fix its location. The utility must be exposed using hand digging methods (i.e. "pot holing") with pick and shovel with care. The Contractor shall

obtain agreement from the Contracting Officer on how much closer to the utility the machine excavations can be allowed. Powered equipment digging shall not be performed within 5 feet of any utility. All powered equipment must be positioned so that it cannot come any closer than 5 feet from the utility. Backhoes must be positioned so that when the arm is in the full extension it cannot come any closer than 5 feet to the utility and the arm must always be drawn away from the utility thus pulling material toward the operator and away from the utility.

#### 1.17.2 Open Flame and Hot Work

The use of an open flame is a Permit Required Operation. Hot work such as welding, torch cutting, sawing metals, flame cutting, burning, grinding, brazing, soldering, and cad welding are all Permit Required Operations. Applying, installing, or removing building materials through the use of heat are also Permit Required Operations. Any operation that can result in the generation of hot flying debris or sparks is a Permit Required Operation. During operations involving possible fire hazard, the Contractor shall notify the Contracting Officer and not proceed until approval is obtained in writing. Open flame and hot work operations must be approved by the Contracting Officer before operations begin. The Contractor shall obtain this approval by submitting a written Request for Open Flame and Hot Work Permit in accordance with Paragraph 1.17 "PERMIT REQUIRED OPERATIONS". The Contractor shall submit this request to the Contracting Officer three (3) calendar days prior to the start of these operations, to enable the Contracting Officer to review measures being taken to prevent hazard to employees, prevent possible fire damage to equipment and property, and prevent unnecessary activation of fire suppression/alarm systems.

The permit, a USAF WELDING, CUTTING AND BRAZING PERMIT, (AF Form 592), must be filled out by the Government and attached to the Contractor's Request for Open Flame and Hot Work Permit. This package must be reviewed and approved by the Dryden Safety Office and approved by the Contracting Officer prior to start of open flame and hot work. After obtaining the approved permit package from the Contracting Officer, the Contractor shall proceed with the open flame and hot work operation in accordance with the approved permit documents. The Contractor or Subcontractor performing the operation shall sign the permit before any open flame and hot work operation is started. The Contractor shall also comply with the requirements stated below.

The Contractor shall discontinue open flame or hot work operations 30 minutes prior to the end of the normal work day. A Contractor employee shall be assigned as Fire Watchman for every open flame and hot work operation. The Watchman shall be equipped with suitable fire extinguishers and shall check all areas around and below the welding or burning operation for fires. The check shall be continued for at least 30 minutes after completion of the open flame or hot work operation to ensure no possible sources of latent combustion.

The Contractor shall provide portable fire extinguishers for fire safety during open flame and hot work operations. When conducting open flame and hot work operations on roofs, the Contractor shall provide and be equipped with one full 20 pound 20-A:120 BC multipurpose dry chemical fire extinguisher and one 2.5 gallon water pressure/spray-pump type portable fire extinguisher placed within 30 feet of the operation. For all other open flame and hot work operations the Contractor shall provide and be equipped with one full 10 pound 4-A:60 BC multipurpose dry chemical fire

extinguisher and one 2.5 gallon water pressure/spray-pump type portable fire extinguisher placed within 30 feet of the operation. The Contracting Officer may request a standby from the Edwards Fire Department; this accommodation does not relieve the Contractor of responsibility for open flame and hot work safety.

Upon completion of open flame or hot work operation (or expiration of Permit), the permit shall be returned to the government.

#### 1.17.3 Utility Outages/Facility Closures

Turning a utility off or on is a Permit Required Operation. Closing a facility or part of a facility is a Permit Required Operation. Streets, walks, and other facilities occupied and used by the Government shall not be closed or obstructed without written permission from the Contracting Officer. Utility outages and facility closures must be approved by the Contracting Officer before outages and closures begin. The Contractor shall obtain this approval by submitting a written Request for Utility Outage/Facility Closure Permit in accordance with Paragraph 1.17 "PERMIT REQUIRED OPERATIONS". The Contractor shall submit this request to the Contracting Officer fourteen (14) calendar days in advance of the planned outage or closure, to enable the Contracting Officer to review measures being taken to prevent hazard to employees and the public, to prevent interruption of any required service, to coordinate the required work with key DFRC activities, and keep Center impact to a minimum.

The permit, a DRYDEN UTILITY SYSTEM OUTAGE APPROVAL (form DFRC-113), must be filled out by the Government and attached to the Contractor's Request for Utility Outage/Facility Closure Permit. This package must be reviewed and approved by the Dryden Safety Office, the Dryden Facilities Engineering & Asset Management Office, the affected Building/Area Manager, and the Contracting Officer prior to initiation of the outage or closure. Notification must also be made to the DFRC Security Office, the DFRC Information Systems Branch, and Center Management. After obtaining the approved permit package from the Contracting Officer, the Contractor shall proceed with the work requiring an outage or closure in accordance with the approved permit documents. The Contractor shall also comply with the requirements stated below.

The shut-down and start-up of the utilities for the outage shall be performed by the government and not the Contractor.

Contractors shall not shut down, shut off, disconnect, block, or otherwise impair any fire protection sprinkler system, fire hydrant, fire alarm system, special extinguishing or other installed fire protection system without an approved Dryden Utility Outage Approval (form DFRC-113).

#### 1.17.4 Crane Operations

Operating a crane is a Permit Required Operation. Setting up a crane is a Permit Required Operation. Cranes shall not be operated without written permission from the Contracting Officer. Crane operations must be approved by the Contracting Officer before crane setup begins. The Contractor shall obtain this approval by submitting a written Request for Crane Operation Permit in accordance with Paragraph 1.17 "PERMIT REQUIRED OPERATIONS". The Contractor shall submit this request to the Contracting Officer seven (7) calendar days in advance of the planned crane operation to enable the Contracting Officer to review measures being taken to prevent hazard to employees and the public, to prevent interruption of any required service,

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to coordinate the required work with key DFRC activities, and keep Center impact to a minimum.

The permit, a CRANE OPERATION APPROVAL (D-WK-800-8), must be filled out by the Government and attached to the Contractor's Plans. The contractor shall prepare the following plans/documents:

1. Description of Work,

List the work to be accomplished during the lifting operation

2. Center Impact Analysis,

List the affects this activity will have on Center occupants and Center operations, i.e. evacuate portions of a building, close a fire lane, require special secure access, close a building exit/entrance, etc.

3. Activity Hazard Analysis

Per paragraph 1.9.1

4. Lift Plan

- a. The exact size and weight of the load.
- b. The maximum load limits for the entire range of the lift.
- c. Height of the lift.
- d. The lift geometry and sequence of actions.
- e. The load radius.
- f. The boom length and angle, for the entire range of the lift.
- g. Ground conditions and outrigger and mats requirements.
- h. A drawing showing the location of the crane and the "from" and "to" pick points, including adjacent buildings, utilities, and other obstructions or hazards.
- i. Rigging procedures and rigging hardware.
- j. Proof of qualification for the crane operator, including a current physician's certificate that meets the requirements of EM 385-1-1, Appendix G (Procedures for the Examination and Qualification of Crane Operators).
- k. Environmental conditions under which lift operations are to be stopped.
- l. Communication and coordination requirements.
- m. The Contractor shall make Personnel Assignments and clearly list by name who will be the Lift Director, Crane Operator, Signalman, Rigger, and Tag Line Persons.
- n. The Contractor shall also complete the Crane Safety Checklist prior to commencing lifting operations.

- o. The Contractor shall perform a practice pick without the load to verify estimated boom angle(s) required to pick, rotate, and set the load.

This package must be reviewed and approved by the Dryden Lift Supervisor and the Chief of Facilities Engineering & Asset Management Office prior to initiation of the crane setup. The Chief of Facilities Engineering & Asset Management Office will assign the Lift Supervisor. Notification must also be made, by NASA project personnel, to the DFRC Security Office, the DFRC Safety Office, and Center Management prior to lifting operations. After obtaining the approved permit package from the Contracting Officer, the Contractor shall proceed with the crane operation in accordance with the approved permit documents.

#### Crane Safety Checklist for Facility Lifts:

##### Things to check

1. Crane certifications and documents have been checked and are current, including:
  - a. Current physician's certificate.
  - b. Insurance.
  - c. Pre-lift Safety Meeting minutes.
2. Operator certifications have been checked and are current.
3. Ancillary lifting equipment certifications (slings, chokers, etc.) are current.
4. Boom angle needed to reach both pick point and set points have been checked and capacity of the crane (AT THOSE BOOM ANGLES) is sufficient to lift the intended load.
5. Capacity of the crane at the horizontal angles required for the pick, rotation, and set have been checked against crane manual and capacity is sufficient for the intended load. (Note: Some cranes, especially crawler cranes that don't have outriggers, DO NOT have the same capacity to the side that they do to the front.)
6. There is sufficient room for crane counterweights to miss all obstructions when the crane rotates horizontally.
7. Clip on crane hook has sufficient spring tension.
8. All people in area are wearing hard hats and safety shoes.
9. Person who is signaling crane operator has been designated and everyone understands who that person is for this operation.
10. Lift Supervisor has been designated and everyone understands who that person is for this operation.
11. Personnel handling tag lines have been designated and they understand that they are not allowed under the load.
12. Ground where outriggers are set has sufficient capacity to resist "punching shear" force which is generated from load and expected geometric configuration of crane.
13. Check for overhead electrical lines within boom radius + 20 feet. Brief the Chief, Facilities Engineering & Asset Management Office on proposed mitigation procedures.
14. Check for underground vaults, tanks, or utilities near the crane location that might collapse or shift causing the crane to shift or sink while under load.
15. Ensure the lifting/hazardous zone is delineated clearly to public (use cones, caution tape, fencing, or other.)

##### Things to do

1. Practice pick shall be made prior to actual lift in order to verify estimated boom angle(s) required to pick the load, rotate the load, and set the load. (Note: This is done without the load.)

#### 1.18 ELECTRICAL SAFETY

Contractor shall appoint an individual responsible for the electrical safety of each work team to restrict entry to dangerous locations to those authorized by him jointly with the Government. Lockout/Tagout controls will be strictly enforced.

Whenever possible, all lines, circuits, and equipment to be worked on shall be de-energized before work is started. If equipment or circuits cannot be de-energized, the Contractor shall provide all necessary personal protective equipment and other protective controls to work on energized lines, circuits, and equipment. Additionally, approval from the Contracting Officer shall be obtained by the Contractor prior to performing work on energized lines, circuits, and equipment.

The Contractor shall use Ground Fault Circuit Interrupters (GFCI) in all circuits used for electric tools and equipment in the construction site. The Contractor shall use GFCIs in all circuits used for temporary lighting in the construction site. GFCIs shall be installed in accordance with the most recent edition of the National Electric Code.

#### 1.19 UNDERGROUND UTILITIES

Safety clearance from the Contracting Officer is required before any Contractor personnel enter a manhole. Contractor shall contact the Contracting Officer for support services at least 24 hours in advance.

Contractor shall be responsible for removing water and debris before commencement and during execution of work in manholes.

##### 1.19.1 PROTECTION OF EXISTING UTILITIES

Existing utilities that are indicated, or the location of which is made known to the Contractor prior to beginning of operations, and utility lines constructed during the Contractor's operation, shall be protected from damage. If the Contractor damages any of these utilities they shall be repaired by the Contractor at no additional cost to the Government. In the event that the Contractor damages any existing utility lines that are not indicated or the locations of which are not known to the Contractor, report thereof shall be made immediately to the Contracting Officer. If the Contracting Officer determines that repairs shall be made by the Contractor, such repairs will be ordered under the clause of the general provisions of the contract entitled "Differing Site Conditions".

#### 1.20 RADIATION SAFETY REQUIREMENTS

License Certificates for radiation materials and equipment shall be submitted to the Contracting Officer for all specialized material and equipment that could cause fatal harm to construction personnel or to the construction project.

Workers shall be protected from radiation exposure in accordance with 10 CFR 20. Standards for Protection Against Radiation.

Loss of radioactive material shall be reported immediately to the

Contracting Officer.

Actual exposure of the radiographic film or unshielding the source shall not be initiated until after 5 p.m. on weekdays.

In instances where radiography is scheduled near or adjacent to buildings or areas having limited access or one-way doors, no assumptions shall be made as to building occupancy. Where necessary, the Contracting Officer will direct the Contractor to conduct an actual building entry, search, and alert. Where removal of personnel from such a building cannot be accomplished and it is otherwise safe to proceed with the radiography, a fully instructed employee shall be positioned inside such building or area to prevent exiting while external radiographic operations are in process.

Use of equipment containing radioactive isotopes or any nuclear sources such as density test, moisture detectors, radiography, etc. must be approved by the Dryden Safety Office and the Contracting Officer. If such equipment is to be used in the work, the Contractor must notify the Dryden Safety Office through the Contracting Officer no less than 14 days prior to the use of such equipment. During the use of such equipment the Dryden Safety Office is authorized to make periodic checks to insure that proper health precautions are being followed. If the Dryden Safety Office determines that these precautions are not being followed, the Dryden Safety Office will immediately notify the Contracting Officer to initiate corrective actions.

#### 1.21 FACILITY OCCUPANCY CLOSURE

Streets, walks, and other facilities occupied and used by the Government shall not be closed or obstructed without written permission from the Contracting Officer.

#### 1.22 PROTECTION OF WORK

Prior to performing any excavation work or any surface penetrations 6 inches or deeper (such as driving stakes more than 6 inches in the ground) on any ground surface, the Contractor shall obtain from the Contracting Officer the current subsurface utility drawing of the particular area to be worked on. Contractor shall stake out subsurface utilities, communication cables and pipe lines indicated within the area of work.

Contractor shall notify the Contracting Officer, 48 hours prior to the start of excavation work or surface penetration, to enable the Contracting Officer to review measures being taken to prevent hazard to employees and possible damage to subsurface utilities. Where emergency conditions preclude the 48 hours advance notification, the Contractor shall immediately inform the Contracting Officer of his intention to initiate work prior to actual start of activity.

After obtaining clearance from the Contracting Officer, the Contractor shall proceed with excavating work, or other surface penetration work. Contractor shall temporarily halt any machine excavation work or other surface penetration when approaching 10 feet 3 meters of an existing utility line until the Contractor has exposed the utility line by hand excavation.

#### 1.23 GAS PROTECTION

Contractor shall have one or more employees properly trained in operation

of gas testing equipment and formally qualified as gas inspectors who shall be on duty during times workmen are in confined spaces. Their primary functions shall be to test for gas and operate testing equipment. Unless equipment of constant supervisory type with automatic alarm is employed, gas tests shall be made at least every 2 hours or more often when character of ground or experience indicates gas may be encountered. A gas test shall be made before workmen are permitted to enter the excavation after an idle period exceeding one-half hour.

Readings shall be permanently recorded daily, indicating the concentration of gas, point of test, and time of test. Submit copies of the gas test readings to the Contracting Officer at the end of each work day.

Special requirements, coordination, and precautions will apply to areas that contain a hazardous atmosphere or, by virtue of their use or physical character, may be oxygen deficient. A check by Government is required prior to entering confined space. Surveillance and monitoring shall be required in these types of work spaces by both Contractor and Government personnel.

#### 1.24 ROOFING AND COATING

At the beginning of each work day the Contractor shall check with the Contracting Officer before proceeding to work on the roof to ensure safe work conditions. Contractor shall comply with 29 CFR 1926.

#### 1.25 HIGH NOISE LEVEL PROTECTION

Operations performed by the Contractor that involve the use of equipment with output of high noise levels (jackhammers, drill hammers, generators, tractors, saws, air compressors, and explosive activated tools, etc.) shall be scheduled for weekends and/or outside normal duty hours. Contractor operations that result in noise levels above 60 dBA in any occupied buildings (offices, laboratories, control rooms, hangars, etc.) and are disruptive to NASA/DFRC business operations shall be performed on weekends or outside normal duty hours. Use of any such equipment shall be approved in writing by the Contracting Officer prior to commencement of work. (Normal duty hours defined in Section 01 14 00 "Work Restrictions", Paragraph 1.4.2 "Working Hours").

Contractor personnel working at NASA/DFRC may need to wear hearing protection as a result of normal aircraft operations. Sonic boom shock waves are a normal everyday occurrence at NASA/DFRC that cause momentary surprise to personnel. The Contractor shall instruct all employees to be aware of this hazard, especially working outdoors at heights.

#### 1.26 SEVERE STORM PLAN

In the event of a severe storm warning, or indications of impending severe weather (e.g. dust storms, damaging wind, heavy rains, floods, tornados, hail, or lightning) the Contractor shall monitor weather conditions and take appropriate precautions including but not limited to:

- a. Secure outside equipment and materials and place materials possible to damage in protected locations.
- b. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.

- c. Ensure that temporary erosion controls are adequate.
- d. Secure materials and equipment that should not be exposed to, or contaminated with, dirt and dust to protect the materials and equipment from damage. This includes mechanical, electrical, and electronic equipment to ensure their function is not compromised. This also includes materials that have aesthetic purpose to ensure appearance is not damaged.

#### 1.27 HAZARDOUS WASTE

When working with hazardous waste and materials, Contractor personnel must wear or use personal protective articles such as protective clothing, respiratory devices, protective shields, etc., appropriate to the task being performed. Provisions are to be made by the Contractor for continuous contact with personnel working with hazardous waste/materials in remote areas.

Contractor shall identify all wastes produced and dispose of them in the following approved manners:

Identify all wastes and waste producing processes including chemicals, paints, Petroleum, Oil and Lubricant (POL) products and solvents, and their containers. All unknown wastes shall be chemically identified.

Obtain a determination of whether the waste is hazardous from the Contracting Officer.

Notify the Contracting Officer prior to taking disposal action for any hazardous waste.

For disposal, provide either laboratory analysis data documenting the chemical content of the waste or certification by appropriate organization authority as to the chemical constituents of the waste. Technical assistance on disposal analysis requirements will be provided on request by contacting the Contracting Officer.

Document the waste type, quantity, location, and personnel/contractor/agency responsible so the material can be tracked from generation through ultimate disposal as required by Environmental Protection Agency under Resource Conservation and Recovery Act.

##### 1.27.1 Chemicals and Hazardous Materials

No chemicals and no hazardous materials such as explosives, flammables, sources of ionizing radiation, corrosives, or toxic substances may be brought onto NASA/DFRC premises without authorization from the Contracting Officer. Provide the Contracting Officer with a copy of the Material Safety Data Sheets (MSDSs) for all chemicals and hazardous materials to be brought on site. All manufacturer recommended precautions shall be followed during the use of any chemicals and hazardous material. MSDSs will be required of all substances deemed to be hazardous by the Contracting Officer. MSDSs must be submitted to the Contracting Officer for approval prior to the use of any chemicals and hazardous substance. Explosives shall not be used or brought to the project site.

Refer to NASA NSS 1740.12 for further guidelines regarding safety with explosives, propellants and pyrotechnics.

1.27.2 Asbestos, Lead Paint, and PCBs

Any work in or around asbestos containing material (ACM) or suspect ACM, including but not limited to insulation; fire proofing; ceiling tiles; flooring materials; roofing materials; or transite, gypsum board, plaster and hollow cell walls, must be approved by the Contracting Officer prior to commencing work.

The use of any construction materials containing asbestos is prohibited.

In the event suspect ACM is identified, and was not previously identified, the contractor shall immediately cease work in the vicinity and inform the Contracting Officer.

Any work involving the disturbance of lead based paint or suspect lead based paint must be approved by the Contracting Officer prior to commencing work.

In the event suspect lead based paint is identified, and was not previously identified, the contractor shall immediately cease work in the vicinity and inform the Contracting Officer.

The use of any paints containing lead or zinc chromate is prohibited.

Any work involving the disturbance of PCBs must be cleared through the Contracting Officer.

1.28 CONFINED SPACE

Comply with the requirements in 29 CFR 1910.146. Any potential for a hazard in the confined space requires a permit system to be used. Comply with the requirements in 29 CFR 1910.146. NASA NPG 8715.3 is available on the internet at <http://nodis3.gsfc.nasa.gov>.

- a. Entry Procedures. Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. (See Local Authority for entry procedures prior to entering confined space).

All hazards pertaining to the space shall be reviewed with each employee before entry.

- b. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained.
- c. Ensure the use of rescue and retrieval devices in confined spaces greater than 5 feet in depth.
- d. Sewer waste walls require continuous atmosphere monitoring with audible alarm for toxic gas detection.
- e. Include training information for employees who will be involved as entrant attendants for the work.

- f. Entry Permit. Use forms DFRC-223, DFRC-224, and/or DFRC-225 or other form with the same minimum information for the Confined Space Entry Permit, completed by the qualified person. Post the permit in a conspicuous place close to the confined space entrance.

Entering a confined space is a Permit Required Operation. Entering a manhole, underground vault, sewage pit, vessel, tank, subfloor area, or other confined space is a permit required operation. Safety clearance from the Contracting Officer is required before any Contractor personnel enter a manhole or vault or any other confined space. Entry must be assessed under Confined Space guidelines. Permit Required Confined Space regulations shall be followed during all confined space entries. Confined space operations must be approved by the Contracting Officer before operations begin. The Contractor shall obtain this approval by submitting a written Request for Confined Space Entry Permit in accordance with Paragraph 1.8 "PERMIT REQUIRED OPERATIONS". The Contractor shall submit this request to the Contracting Officer three (3) calendar days prior to the start of these operations, to enable the Contracting Officer to review measures being taken to prevent hazard to employees.

The permit, a CONFINED SPACE ENTRY PERMIT (forms DFRC-223, DFRC-224, and/or DFRC-225), must be filled out by the Government and attached to the Contractor's Request for Confined Space Entry Permit. This package must be reviewed and approved by the Dryden Safety Office and approved by the Contracting Officer prior to entry. After obtaining the approved permit package from the Contracting Officer, the Contractor shall proceed with the confined space operation in accordance with the approved permit documents. The Contractor shall also comply with the requirements stated below.

All work within manholes and other confined spaces shall be considered permit required confined space entry work, unless otherwise designated by the Contracting Officer. Contractor shall be responsible for removing water and debris before commencement and during execution of work in manholes and vaults. The Contractor shall have one or more confined space entry attendants/entry supervisors who are properly trained in the operation of gas monitoring equipment and formally qualified as confined space entry attendants/entry supervisors who shall be on duty during times workmen are in confined spaces. Their primary functions shall be to monitor the confined space. Gas monitoring shall be performed prior to entry and continuously when anyone is in the confined space. Readings shall be permanently recorded daily, indicating the concentration of gas, location and time the space was monitored.

Special requirements, coordination, and precautions will apply to areas that contain a hazardous atmosphere or, by virtue of their use or physical character, may be oxygen deficient. A breathing hazard check by the Government is required prior to entering areas that contain a hazardous atmosphere or, by virtue of their use or physical character, may be oxygen deficient. Surveillance and monitoring shall be required in these types of workspaces by both Contractor and Government personnel.

#### 1.29 BARRICADING WORK AREAS

Areas made hazardous to workers, project personnel, the public, or other persons by Contractor operations shall be barricaded as follows:

- a. All lay down areas, excavations, breaks in roads, breaks in floors, and similar conditions shall be barricaded to prevent injury to personnel and reduce the possibility of damage to moving equipment. The

Contractor shall continuously barricade all lay down areas, excavations, breaks in roads, breaks in floors, and similar conditions with temporary vertical chain link fencing or vertical plywood fencing.

- b. When the lay down areas, excavations, breaks in roads, breaks in floors, and similar conditions are within 20 feet of the edge of roads, parking lots, and pedestrian routes, the Contractor shall furnish and install battery powered flasher type warning lights on a maximum spacing of not less than one flasher every 15 feet on at least one side of any excavation or opening.
- c. Steel plates used to cover excavations in roadways shall be sufficient to safely support all vehicle loads.
- d. Identify and flag all fire sprinkler heads when using ladders in work area.

#### 1.30 FALL HAZARDS

When work is performed at heights which expose workers, project personnel, the public, or other persons to falling objects, such areas shall be barricaded, restricted, or protected.

When work is performed at heights which expose workers, and inspectors to falls, the Contractor shall provide fall protection. The Contractor shall check with the Contracting Officer before commencing roofing work or any activity on a roof and shall ensure safe work conditions. When working from an aerial lift workers shall use a body harness and lanyard system appropriately attached to the boom or basket.

Each employee on a walking/working surface 4 feet or more above lower levels shall be protected from falling by a guardrail system, safety net system, or personal fall arrest system.

#### 1.31 PERSONAL PROTECTIVE AND SAFETY EQUIPMENT

All construction areas at DFRC are considered hard hat areas. All persons working on or visiting the project site shall wear hard hats (ANSI Z89.1 Type I or Type II).

All Contractor employees and Subcontractors shall wear clothing suitable for the weather and work conditions. The minimum for field work shall be short sleeve shirt, long trousers, and steel-toed safety boots (ANSI Z41).

For purposes of inspecting the work under this contract, the Contractor shall provide personal protective and safety equipment to the Government inspector for use during inspections. This includes but is not limited to body harnesses, lanyards, lifelines, ladders, aerial lifts, respirators, safety glasses, face shields, shade lenses, etc. This does not include hard hats and steel-toed safety boots.

#### 1.32 ENVIRONMENTAL PROTECTION

The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract shall be protected during the entire period of this contract.

#### 1.32.1 Desert Tortoise Protection

The Desert Tortoise is a threatened species under the Federal Endangered Species Act, and the Contractor shall ensure that they are protected throughout the project site. For work sites outside the NASA Dryden fenceline, but within the lease boundary, the superintendent and all contract employees involved in earthwork operations shall view a NASA training film about the Desert Tortoise, approximately 1 hour long. The Contractor shall take extreme care to protect the Desert Tortoise when in the clean soil disposal site.

#### 1.32.2 Cultural Resource Protection

In the event cultural or historical materials are found during the performance of this contract, work will cease immediately in the find area and the Contracting Officer shall be notified accordingly.

#### 1.32.3 Air Quality

The Contractor's operations shall satisfy air quality requirements for Kern County Air Pollution Control District, including permits for all temporary, portable construction equipment with internal combustion engines rated over 50 bhp.

#### 1.32.4 Water Quality

The Contractor's operations shall satisfy water quality requirements for the Lahontan Regional Water Quality Control Board.

#### 1.33 DUST CONTROL

The Contractor shall maintain excavations, embankments, stockpiles, temporary roads, plant sites, waste areas, borrow areas, and other work areas within or beyond the project site free from dust which would cause a hazard or nuisance to others. Methods of stabilization consisting of water sprinkling, chemical treatment, light bituminous treatment or similar methods will be permitted to control dust. Sprinkling shall be repeated at such intervals as to keep the disturbed area damp at all times. Dust control shall be performed as the work proceeds and whenever a nuisance or hazard occurs.

When the jobsite is inside an occupied building, the Contractor shall provide and install dust barriers to control dust movement so that dirt and dust does not migrate out of the construction site and into occupied sections of the building. Any corridors, offices, and other rooms that become contaminated by dirt and dust migrating from the Contractor's activity shall be cleaned, dusted, and vacuumed by the Contractor at no expense to the Government.

#### 1.34 FIRST AID AND EMERGENCIES

The contractor shall maintain a 16-unit first aid kit on the job site clearly located and marked. The Contractor's Site Safety Officer shall inspect the kit every work day; see Paragraph 1.12.2 "Daily Safety Meetings/Daily Safety Inspections".

Contractor personnel who sustain injury or become ill, on-site during normal duty hours, may be examined and/or given first aid treatment at the NASA/DFRC Dispensary in Building 4822, telephone (661) 276-3258 or (661)

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276-3570. Outside normal duty hours the Contractor is responsible for first aid treatment of employees and transportation to a medical facility off-site. All injuries sustained on-site must be reported to the Contracting Officer whether treated at the NASA/DFRC facility or elsewhere. (Normal duty hours are defined in Section 01 14 00 "Work Restrictions".)

Emergency telephone numbers and reporting instructions shall be conspicuously posted at the job site. Fire, rescue, and first aid are available by contacting 911 on a NASA/DFRC telephone. If a NASA/DFRC phone is not available in an emergency, call Security post 1 at (661) 276-3256 and clearly explain the emergency. A direct 911 contact cannot be made by use of a personal or cellular phone. To summarize, in an emergency from:

- |                               |      |                |
|-------------------------------|------|----------------|
| a. NASA/DFRC phone            | dial | 911            |
| b. Personal or Cellular phone | dial | (661) 276-3256 |

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 35 40.00 20

ENVIRONMENTAL MANAGEMENT

02/10

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 NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z400.1 (2004) Hazardous Industrial Chemicals -  
Material Safety Data Sheets - Preparation

ASTM INTERNATIONAL (ASTM)

ASTM D 4840 (1999; R 2010) Sampling Chain-Of-Custody  
Procedures

ASTM E 2114 (2008) Standard Terminology for  
Sustainability Relative to the Performance  
of Buildings

U.S. DEPARTMENT OF AGRICULTURE (USDA)

Biomass R&D Act (2000) Biomass Research and Development Act

U.S. Farm Bill (2002) U.S. Farm Bill of May 2002

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

NPDES (1972; R 2005) National Pollutant  
Discharge Elimination System

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

40 CFR 261 Identification and Listing of Hazardous  
Waste

1.2 DEFINITIONS

Definitions pertaining to sustainable development are as defined in ASTM E 2114 and as specified.

- a. "Biobased content" is calculated as the weight of the biobased material divided by the total weight of the product, and is expressed as a percentage by weight.
- b. "Biobased materials" include fuels, chemicals, building materials, or electric power or heat produced from biomass as defined by the Biomass R&D Act. Minimum biobased content shall be as defined in the U.S. Farm Bill.
- c. "Chain-of-custody" is a process whereby a product or material is

maintained under the physical possession or control during its entire life cycle.

- d. "Pollution and environmental damage" is caused by the presence of chemical, physical, or biological elements or agents. Human health or welfare is adversely affected; ecological balances are unfavorably altered; the utility of the environment for aesthetic, cultural, or historical purposes degrades.

### 1.3 PRECONSTRUCTION MEETING

After award of Contract and prior to commencement of the work, the Contractor shall schedule and conduct a meeting with the Contracting Officer to discuss the proposed Environmental Protection Plan and to develop a mutual understanding relative to the details of environmental protection. The requirements for this meeting may be fulfilled during the coordination and mutual understanding meeting as specified in Section 01 45 00.10 40 DRYDEN CONSTRUCTION CONTRACTOR QUALITY CONTROL.

### 1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

#### SD-01 Preconstruction Submittals

Environmental Protection Plan; G

Instructor Qualifications

Submit reference data to demonstrate instructors' individual and firm's capabilities and experience.

#### SD-03 Product Data

#### SD-06 Test Reports

Field Quality Control Reports

#### SD-07 Certificates

Environmental Regulatory Requirements

For Government's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with environmental regulations bearing on performance of the work.

#### SD-08 Manufacturer's Instructions

Material Safety Data Sheets

#### SD-11 Closeout Submittals

Protection of Natural Resources

Contractor's NPDES/SWPPP

#### 1.5 CONTRACTOR'S ENVIRONMENTAL MANAGER

Designate an on-site Environmental Manager responsible for overseeing the environmental goals for the project and implementing procedures for environmental protection.

##### 1.5.1 Duties

The Environmental Manager shall be responsible for the following:

- a. Compliance with applicable federal, state, and local environmental regulations, including maintaining required documentation.
- b. Implementation of the Waste Management Plan.
- c. Implementation of the Indoor Air Quality (IAQ) Management Plan.
- d. Implementation of the Environmental Protection Plan.
- e. Environmental training for Contractor personnel in accordance with their position requirements.
- f. Monitoring and documentation of environmental procedures.

##### 1.5.2 Qualifications

Minimum 5 years construction experience on projects of similar size and scope; minimum 2 years' experience with environmental procedures similar to those of this project; familiarity with environmental regulations applicable to construction operations.

#### 1.6 ENVIRONMENTAL REGULATORY REQUIREMENTS

The Contractor shall be responsible for knowing federal, state, and local regulatory requirements pertaining to legal disposal of all construction and demolition waste materials. Comply with all applicable regulations and maintain records of permits, licenses, certificates, and other environmental regulatory requirement correspondences.

#### 1.7 ENVIRONMENTAL REQUIREMENTS FOR PRODUCTS

##### 1.7.1 Material Safety Data Sheets (MSDS)

Submit an MSDS for each product specified in other sections or required by OSHA to have an MSDS. MSDS shall be prepared within the previous five years. Include information for MSDS Sections 1 through 16 in accordance with ANSI Z400.1 and as follows:

- a. Section 11: Include data used to determine the hazards cited in Section 3. Identify acute data, carcinogenicity, reproductive effects, and target organ effects.
- b. Section 12: Include data regarding environmental impacts during raw materials acquisition, manufacture, and use. Include data regarding environmental impacts in the event of an accidental release.
- c. Section 13: Include data regarding the proper disposal of the

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chemical. Include information regarding recycling and reuse. Indicate whether or not the product is considered to be "hazardous waste" according to 40 CFR 261.

- d. Section 14: Identify hazard class for shipping.
- e. Section 15: Identify federal, state, and local regulations applicable to the material.
- f. Section 16: Include additional information relative to recycled content, biobased content, and other information regarding environmental and health impacts. Identify the date MSDS was prepared.

1.8 ENVIRONMENTAL PROTECTION PLAN

Prepare and submit an Environmental Protection Plan not less than 10 days before the preconstruction meeting. At a minimum, address the following elements in accordance with this section:

- a. Identification and contact information for Environmental Manager.
- b. General site information, including preconstruction description and photographs.
- c. Summary of training program.
- d. Procedures to address water resources.
- e. Procedures to address land resources.
- f. Procedures to address air resources.
- g. Procedures to address fish and wildlife resources.
- h. Monitoring and quality control procedures.

Revise and resubmit Plan as required by the Contracting Officer. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.

1.9 ENVIRONMENTAL DEMONSTRATION AND TRAINING

Contractor shall provide environmental training for workers performing work on the project site.

1.9.1 Instructor Qualifications

Training shall be given by a firm or individual experienced in providing training or education similar in content and extent to that indicated for this project.

1.9.2 Coordination

Coordinate instruction schedule with Government operations. Adjust schedule as required to minimize disruption of Government operations. Coordinate instruction with demonstration and training of general building systems.

PART 2 PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

Consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, and disposal of products, and provide products and materials with the least effect on the environment, released toxins, and other methods.

2.1.1 Prohibited Materials

The use of the following materials is prohibited:

- a. Products containing asbestos.
- b. Products containing urea formaldehyde.
- c. Products containing polychlorinated biphenyls (PCBs).
- d. Products containing chlorinated fluorocarbons.
- e. Solder or flux containing more than 0.2 percent lead and domestic water pipe or pipe fittings containing more than 8 percent lead.
- f. Paint containing more than 0.06 percent lead.

2.1.2 Substitutions

Notify the Contracting Officer when Contractor is aware of materials, equipment, or products that meet the aesthetic and programmatic intent of Contract Documents, but which are more environmentally responsible than materials, equipment, or products specified or indicated in the Contract Documents. Submit the following for initial review by the Contracting Officer:

- a. Product data including manufacturer's name, address, and phone number.
- b. Description of environmental advantages of proposed substitution over specified product.

PART 3 EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

Comply with applicable regulations and these specifications. Preserve the natural resources within the project boundaries and outside the limits of permanent work performed under this Contract in their existing condition or restore to an equivalent or improved condition as approved by the Contracting Officer. Where violation of environmental procedures requirements will irreversibly damage the site, Contractor shall notify the Contracting Officer immediately.

3.1.1 General Disturbance

Confine demolition and construction activities to work area limits indicated on the Drawings. Remove debris, rubbish, and other waste materials resulting from demolition and construction operations from site. Transport materials with appropriate vehicles and dispose of them off site.

to areas that are approved for disposal by governing authorities having jurisdiction. Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways. Remove spillage and sweep, wash, or otherwise clean project site, streets, or highways. Burning is prohibited.

### 3.1.2 Water Resources

The Contractor's NPDES/SWPPP shall comply with requirements of the NPDES and the applicable State Pollutant Discharge Elimination System (SPDES). In California this is known as the "State Water Pollution Prevention Plan" (SWPPP). Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water. Store and service construction equipment at areas designated for collection of oil wastes. Prevent ponding of stagnant water conducive to mosquito breeding habitat. Prevent run-off from site during demolition and construction operations.

### 3.1.3 Land Resources

Prior to construction, identify land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and landforms without permission from the Contracting Officer. Coordinate protection practices with work specified in Division 2 SITEWORK.

#### 3.1.3.1 Erodible Soils

Plan and conduct earthwork to minimize the duration of exposure of unprotected soils, except where the constructed feature obscures borrow areas, quarries, and waste material areas. Clear areas in reasonably sized increments only as needed to use the areas developed. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.

#### 3.1.3.2 Erosion and Sedimentation Control Devices

Construct or install temporary and permanent erosion and sedimentation control features as required.

#### 3.1.3.3 Tree and Plant Protection

Protect as specified in Division 2 SITEWORK and as specified. Prior to start of construction, tag each tree and plant scheduled to remain. In the event of damage to tree or plant, the Government may, at the Contracting Officer's discretion, deduct the indicated value of the damaged tree or plant from the Contract Sum.

### 3.1.4 Air Resources

Comply with Indoor Air Quality (IAQ) Management Plan and as follows:

- a. Prevent creation of dust, air pollution, and odors.
- b. Sequence construction to avoid unnecessary disturbance to site.
- c. Use mulch, water sprinkling, temporary enclosures, and other appropriate methods as needed to limit dust and dirt rising and scattering in air. Do not use water when it may create hazardous or other adverse conditions such as flooding and pollution.

- d. Store volatile liquids, including fuels and solvents, in closed containers. Do not store with materials that have a high capacity to adsorb VOC emissions or in occupied spaces.
- e. Properly maintain equipment to reduce gaseous and particulate pollutant emissions.

#### 3.1.5 Fish and Wildlife Resources

Manage and control construction activities to minimize interference with and damage to wildlife. Do not disturb wildlife. Do not alter water flows or otherwise significantly disturb the native habitat related to the project and critical to the survival of wildlife, except as indicated or specified.

#### 3.2 FIELD QUALITY CONTROL

Comply with requirements of agencies having jurisdiction and as specified herein. Provide field practices, shipping, and handling of samples in accordance with ASTM D 4840. Provide Field Quality Control Reports in accordance with approved Environmental Protection Plan.

-- End of Section --

SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS  
08/10

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization, (e.g. ASTM B 564 Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number.

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PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not used

-- End of Section --

SECTION 01 45 00.10 40

CONTRACTOR QUALITY CONTROL

02/10

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.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2008; Change 1-2010; Change 3-2010;  
Errata 1-2010) Safety and Health  
Requirements Manual

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00  
SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

QC Plan; G

Submit a QC plan within 15 calendar days after receipt of Notice  
to Proceed (NTP).

1.3 INFORMATION FOR THE CONTRACTING OFFICER (CO)

During construction, report forms to be used include: Contractor Quality  
Control (CQC) Report, Preparatory Phase Checklist, Initial Phase Checklist,  
Discrepancy List, and Testing Plan and Log.

Deliver the following to the CO:

- a. CQC Report: Original and one copy, by 10:00 AM the next  
working day after each day that work is performed;
- c. Preparatory Phase Checklist: Original attached to the  
original CQC Report and one copy attached to each copy;
- d. Initial Phase Checklist: Original attached to the original  
CQC Report and one copy attached to each copy;
- e. Field Test Reports (per the Testing Plan & Log): One copy,  
within two working days after the test is performed, attached to  
the CQC Report;
- f. QC Meeting Minutes: One copy, within two working days after  
the meeting; and
- g. QC Certifications: As required by the paragraph entitled "QC  
Certifications."

#### 1.4 QC PROGRAM REQUIREMENTS

Establish and maintain a QC program as described in this section. The QC program consists of a QC Manager, a QC plan, participation in weekly project meetings, QC meetings, three phases of control, submittal review and approval, testing, and QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations which comply with the requirements of this contract. The QC program shall cover on-site and off-site work and shall be keyed to the work sequence. No work or testing may be performed unless the QC Manager is on the work site.

##### 1.4.1 Preliminary Work Authorized Prior to Acceptance

The only work that is authorized to proceed prior to the acceptance of the QC plan is mobilization of storage and office trailers, temporary utilities, and surveying.

##### 1.4.2 Acceptance

Acceptance of the QC plan is required prior to the start of construction. The CO reserves the right to require changes in the QC plan and operations as necessary, including removal of personnel, to ensure the specified quality of work. The CO reserves the right to interview any member of the QC organization at any time in order to verify the submitted qualifications.

##### 1.4.3 Notification of Changes

Notify the CO, in writing, of any proposed change, including changes in the QC organization personnel, a minimum of seven calendar days prior to a proposed change. Proposed changes shall be subject to the acceptance by the CO.

#### 1.5 QC ORGANIZATION

##### 1.5.1 QC Manager

###### 1.5.1.1 Duties

Provide a QC Manager at the work site to implement and manage the QC program. The QC Manager is required to attend the weekly project meetings, conduct the QC meetings, perform the three phases of control, perform submittal review and approval, ensure testing is performed and provide QC certifications and documentation required in this contract. The QC Manager is responsible for managing and coordinating the three phases of control and documentation performed by others.

###### 1.5.1.2 Qualifications

An individual with a minimum of 5 years combined experience as a superintendent, inspector, QC Manager, project manager, or construction manager on similar size and type construction contracts which included the major trades that are part of this contract. The individual must be familiar with the requirements of the EM 385-1-1 and have experience in the areas of hazard identification and safety compliance.

###### 1.5.1.3 Construction Quality Management Training

In addition to the above experience and education requirements, the QC

Manager shall have completed the US Army Corps of Engineers course " Construction Quality Management for Contractors" and will have a current certificate.

#### 1.5.2 Alternate QC Manager Duties and Qualifications

Designate an alternate for the QC Manager to serve in the event of the designated QC Manager's absence. The period of absence may not exceed two weeks at one time, and not more than 30 workdays during a calendar year. The qualification requirements for the Alternate QC Manager shall be the same as for the QC Manager.

### 1.6 QC PLAN

#### 1.6.1 Requirements

Provide, for acceptance by the CO, a QC plan submitted in a three-ring binder that covers both on-site and off-site work and includes the following with a table of contents listing the major sections identified with tabs.

- I. QC ORGANIZATION: A chart showing the QC organizational structure and its relationship to the production side of the organization.
- II. NAMES AND QUALIFICATIONS: In resume format, for each person in the QC organization. Include the CQM for Contractors course certification required by the paragraph entitled "Construction Quality Management Training".
- III. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONAL: Of each person in the QC organization.
- IV. OUTSIDE ORGANIZATIONS: A listing of outside organizations such as consulting engineering firms that will be employed by the Contractor and a description of the services these firms will provide.
- V. APPOINTMENT LETTERS: Letters signed by an officer of the firm appointing the QC Manager and Alternate QC Manager and stating that they are responsible for managing and implementing the QC program as described in this contract. Include in this letter the QC Manager's authority to direct the removal and replacement of non-conforming work.
- VI. SUBMITTAL PROCEDURES AND INITIAL SUBMITTAL REGISTER: Procedures for reviewing, approving and managing submittals. Provide the name(s) of the person(s) in the QC organization authorized to review and certify submittals prior to approval.
- VII. TESTING LABORATORY INFORMATION: Testing laboratory information required by the paragraphs "Accredited Laboratories" or "Testing Laboratory Requirements", as applicable.
- VIII. TESTING PLAN AND LOG: A Testing Plan and Log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test.
- IX. PROCEDURES TO COMPLETE DISCREPANCY LIST: Procedures to identify,

record, track and complete discrepancies.

- X. DOCUMENTATION PROCEDURES: Use Government formats.
- XI. LIST OF DEFINABLE FEATURES OF WORK: A Definable Feature of Work (DFOW) is a task, which is separate and distinct from other tasks, has the same control requirements and work crews. The list shall be cross-referenced to the Contractor's Construction Schedule and the specification sections. For projects requiring a Progress Chart, the list of definable features of work shall include but not be limited to all items of work on the schedule.
- XII. PROCEDURES FOR PERFORMING THREE PHASES OF CONTROL: For each DFOW provide Preparatory and Initial Phase Checklists. Each list shall include a breakdown of quality checks that will be used when performing the quality control functions, inspections, and tests required by the contract documents. The preparatory and initial phases shall be conducted with a view towards obtaining quality construction by planning ahead and identifying potential problems.
- XIII. PROCEDURES FOR COMPLETION INSPECTION: See the paragraph entitled "COMPLETION INSPECTIONS".

#### 1.7 QC MEETINGS

After the start of construction, during the weekly project meetings Quality Control shall be addressed at the work site with the superintendent, QC Manager and the foreman responsible for the ongoing and upcoming work. The Contractor shall prepare the minutes of the meeting and provide a copy to the CO within two working days after the meeting. As a minimum, the following shall be accomplished at each meeting:

- a. Review the minutes of the previous meeting;
- b. Review the schedule and the status of work and rework;
- c. Review the status of submittals;
- d. Review the work to be accomplished in the next two weeks and documentation required;
- e. Resolve QC and production problems (RFIs, etc.);
- f. Address items that may require revising the QC plan; and
- g. Review Accident Prevention Plan (APP).

#### 1.8 THREE PHASES OF CONTROL

The three phases of control shall adequately cover both on-site and off-site work and shall include the following for each DFOW.

##### 1.8.1 Preparatory Phase

Notify the CO at least five work days in advance of each preparatory phase. Conduct the preparatory phase with the superintendent and the foreman responsible for the definable feature of work. Document the results of the preparatory phase actions in the daily CQC Report and in the QC checklist. Perform the following prior to beginning work on each

definable feature of work:

- a. Review each paragraph of the applicable specification sections;
- b. Review the contract drawings;
- c. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required;
- d. Review the testing plan and ensure that provisions have been made to provide the required QC testing;
- e. Examine the work area to ensure that the required preliminary work has been completed;
- f. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data;
- g. Review the APP and appropriate Activity Hazard Analysis (AHA) to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted; and
- h. Discuss specific controls used and the construction methods and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each DFOV.

#### 1.8.2 Initial Phase

Notify the CO at least five work days in advance of each initial phase. When construction crews are ready to start work on a DFOV, conduct the Initial Phase with the foreman responsible for that DFOV. Observe the initial segment of the work to ensure that it complies with contract requirements. Document the results of the Initial Phase in the daily CQC Report and in the QC checklist. Perform the following for each DFOV:

- a. Establish the quality of workmanship required;
- b. Resolve conflicts;
- c. Ensure that testing is performed by the approved laboratory; and
- d. Check work procedures for compliance with the APP and the appropriate AHA to ensure that applicable safety requirements are met.

#### 1.8.3 Follow-Up Phase

Perform the following for on-going work daily, or more frequently as necessary, until the completion of each DFOV and document in the daily CQC Report and in the QC checklist:

- a. Ensure the work is in compliance with contract requirements;
- b. Maintain the quality of workmanship required;
- c. Ensure that testing is performed by the approved laboratory;

- d. Ensure that discrepancies are being corrected; and
- e. Assure manufacturers' representatives have performed necessary inspections, if required.

#### 1.8.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same DFOW if the quality of on-going work is unacceptable, if there are changes in the applicable QC organization, if there are changes in the on-site production supervision or work crew, if work on a DFOW is resumed after substantial period of inactivity, or if other problems develop.

#### 1.8.5 Notification of Three Phases of Control for Off-Site Work

Notify the CO at least two weeks prior to the start of the preparatory and initial phases.

#### 1.9 SUBMITTAL REVIEW AND APPROVAL

Procedures for submission, review, and approval of submittals are described in the submittal section of the specification.

#### 1.10 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under this contract.

##### 1.10.1 Accreditation Requirements

Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (i.e.; E 329, C 1077, D 3666, D 3740, A 880, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office."

##### 1.10.2 Laboratory Accreditation Authorities

Laboratory Accreditation Authorities include the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology, the American Association of State Highway and Transportation Officials (AASHTO), International Accreditation Services, Inc. (IAS), U. S. Army Corps of Engineers Materials Testing Center (MTC), and the American Association for Laboratory Accreditation (A2LA).

##### 1.10.3 Capability Check

The CO retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this contract.

#### 1.10.4 Test Results

Cite applicable Contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If the item fails to conform, notify the CO immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results shall be signed by a testing laboratory representative authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the CO.

#### 1.11 QC CERTIFICATIONS

##### 1.11.1 Contractor Quality Control Report Certification

Each CQC Report shall contain the following statement: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge except as noted in this report."

##### 1.11.2 Completion Certification

Upon completion of work under this contract, the QC Manager shall furnish a certificate to the CO attesting that "the work has been completed, inspected, tested and is in compliance with the contract."

#### 1.12 COMPLETION INSPECTIONS

##### 1.12.1 GOVERNMENT INSPECTION

Government in-process and end-item inspections will be performed at the construction site and at the Contractor's and/or subcontractor(s)' facilities by a designated Government representative to assure compliance with the contract requirements, drawings, and technical specifications. The extent of such inspection will depend upon the level of quality and workmanship of the items. The Contractor shall notify the Contracting Officer of scheduled inspections a minimum of 48 hours prior to such scheduled inspections.

The Contractor shall give 24-hour advance notice to the Contracting Officer of the date when the contract work will begin at the site to allow coordination with the inspection staff. Should the Contractor unexpectedly suspend work at any time prior to completion of the contract, the Contractor shall notify the Contracting Officer as soon as possible. If work is suspended for 3 days or longer, the Contractor shall not resume work without notifying the Contracting Officer 24-hours in advance.

##### 1.12.2 Discrepancy List Inspection

Near the completion of all work or any increment thereof the CQC Manager shall conduct an inspection of the work and develop a discrepancy list of items which do not conform to the approved drawings and specifications. The discrepancy list shall include the estimated date by which the deficiencies will be corrected. A copy of the discrepancy list shall be provided to the Government. The CQC Manager or staff shall make follow-on inspections to ascertain that all deficiencies have been corrected. The Contractor shall then notify the Government that the facility is ready for the Government

inspection.

#### 1.12.3 Pre-Final Inspection

The QC manager will perform this inspection to verify that the facility is complete and ready to be occupied. The QC Manager shall ensure that all items on this list are corrected prior to notifying the Government that a "Final" inspection with the customer can be scheduled.

#### 1.12.4 Final Acceptance Inspection

The QC Manager, the superintendent, or other Contractor management personnel and the CO will be in attendance at this inspection. Additional Government personnel may be in attendance. Notice shall be given by the CO at least 14 days prior to the Final Punch List inspection. The Final Punch List inspection will be formally scheduled by the CO. The notice shall state that all specific items previously identified to the Contractor as being unacceptable will be complete by the date scheduled for the Final Punch List inspection.

#### 1.13 DOCUMENTATION

Maintain current and complete records of on-site and off-site QC program operations and activities. The forms identified under the paragraph "INFORMATION FOR THE CONTRACTING OFFICER (CO)" shall be used. Reports are required for each day work is performed. Account for each calendar day throughout the life of the contract. The superintendent and the QC Manager must prepare and sign the Contractor Production and CQC Reports, respectively. The reporting of work shall be identified by terminology consistent with the construction schedule. In the "remarks" section in this report which will contain pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the work site. For each remark given, identify the Schedule Activity No. that is associated with the remark.

##### 1.13.1 Quality Control Validation

Establish and maintain the following in a series of three ring binders. Binders shall be divided and tabbed as shown below. These binders shall be readily available to the Government's Quality Assurance Team during all business hours.

- a. All completed Preparatory and Initial Phase Checklists, arranged by specification section.
- b. All milestone inspections, arranged by Activity/Event Number.
- c. A current up-to-date copy of the Testing and Plan Log with supporting field test reports, arranged by specification section.
- d. Copies of all contract modifications, arranged in numerical order. Also include documentation that the modified work was accomplished.
- e. A current up-to-date copy of the Discrepancy List, corrective action plan, and documentation of corrections made to defective

work.

- f. Maintain up-to-date copies of all punch lists issued by the QC Staff on the Contractor and Sub-Contractors and all punch lists issued by the Government.

#### 1.13.2 As-Built Drawings

The QC Manager shall review the as-built drawings, as required in Section 01 78 00 CLOSEOUT SUBMITTALS, to ensure they are kept current on a daily basis and marked to show deviations from the Contract drawings. Ensure each deviation has been identified with the appropriate modifying documentation (e.g. modification number, RFI number, etc.). The QC Manager shall initial each deviation or revision that was approved by the CO. Upon completion of work, the QC Manager shall submit a certificate attesting to the accuracy of the as-built drawings prior to submission to the CO.

The Contractor shall maintain at the jobsite two sets of full-size prints of the contract drawings, accurately marked in red with adequate dimensions, to show all variations between the construction actually provided and that indicated or specified in the contract documents, including buried or concealed construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the contract drawings. Existing utility lines and features revealed during the course of construction shall also be accurately located and dimensioned. Variations in the interior utility systems shall be clearly defined and dimensioned; and coordinated with exterior utility connections at the building five-foot line, where applicable. Existing topographic features which differ from those shown on the contract drawings shall also be accurately located and recorded. Where a choice of materials or methods is permitted herein, or where variations in scope or character of methods is permitted herein, or where variations in scope or character of work from that of the original contract are authorized, the drawings shall be marked to define the construction actually provided. The representations of such changes shall conform to standard drafting practice and shall include such supplementary notes, legends, and details as necessary to clearly portray the as-built construction. These drawings shall be available for review by the Contracting Officer at all times. Upon completion of the work, both sets of the marked up prints shall be certified as correct, signed by the Contractor, and delivered to the Contracting Officer for his approval before acceptance.

#### 1.14 NOTIFICATION OF NON-COMPLIANCE

The CO will notify the Contractor of any detected non-compliance with the foregoing requirements. The Contractor shall take immediate corrective action. If the contractor fails or refuses to correct the non-compliant work, the CO will issue a non-compliance notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the CO may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall make no part of the time lost due to such stop orders the subject of claim for extension of time, for excess costs, or damages.

#### PART 2 PRODUCTS

Not Used

NASA - REPAIR CENTERWIDE FIRE MAIN  
FINAL DESIGN

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS  
08/09

PART 1 GENERAL

1.1 SUMMARY

Requirements of this Section apply to, and are a component of, each section of the specifications.

1.2 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 WATER WORKS ASSOCIATION (AWWA)

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

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH  
(FCCCHR)

FCCCHR List (continuously updated) List of Approved  
Backflow Prevention Assemblies

FCCCHR Manual (1988e9) Manual of Cross-Connection Control

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241 (2009) Standard for Safeguarding  
Construction, Alteration, and Demolition  
Operations

NFPA 70 (2011) National Electrical Code

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1 (2007; Rev K) Obstruction Marking and  
Lighting

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD (2000) Manual of Uniform Traffic Control  
Devices

1.3 SUBMITTALS

Submitted the following in accordance with Section 01 33 00 SUBMITTAL  
PROCEDURES:

SD-01 Preconstruction Submittals

Construction site plan; G

Traffic control plan; G

SD-06 Test Reports

Backflow Preventer Tests

SD-07 Certificates

Backflow Tester Certification

Backflow Preventers Certificate of Full Approval

#### 1.4 CONSTRUCTION SITE PLAN

Prior to the start of work, the Contractor shall submit a site plan showing the locations and dimensions of temporary facilities (including layouts and details, equipment and material storage area onsite and offsite, and access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation). Identify any areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.

#### 1.5 BACKFLOW PREVENTERS CERTIFICATE

Certificate of Full Approval from FCCCHR List, University of Southern California, attesting that the design, size and make of each backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. Certificate of Provisional Approval will not be acceptable.

##### 1.5.1 Backflow Tester Certificate

Prior to testing, submit to the Contracting Officer certification issued by the State or local regulatory agency attesting that the backflow tester has successfully completed a certification course sponsored by the regulatory agency. Tester must not be affiliated with any company participating in any other phase of this Contract.

##### 1.5.2 Backflow Prevention Training Certificate

Submit a certificate recognized by the State or local authority that states the installer has completed at least 10 hours of training in backflow preventer installations. The certificate must be current.

##### 1.5.3 Backflow Preventers

Reduced pressure principle type conforming to the applicable requirements AWWA C511. The particular make, model/design, and size of backflow preventers to be installed must be included in the latest edition of the List of Approved Backflow Prevention Assemblies issued by the FCCCHR List and be accompanied by a Certificate of Full Approval from FCCCHR List. After installation conduct Backflow Preventer Tests and provide test reports verifying that the installation meets the FCCCHR Manual Standards.

NASA - REPAIR CENTERWIDE FIRE MAIN  
FINAL DESIGN

PART 2 PRODUCTS

2.1 TEMPORARY SIGNAGE

2.1.1 Bulletin Board

Immediately upon beginning of work, provide a weatherproof bulletin board for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer.

2.1.2 Project and Safety Signs

The requirements for the signs, their content, and location are as shown on the drawings. Erect signs within 15 days after receipt of the notice to proceed. Correct the data required by the safety sign daily, with light colored metallic or non-metallic numerals.

2.2 TEMPORARY TRAFFIC CONTROL

2.2.1 Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic barricades will be required. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

2.2.2 Fencing

Provide fencing along the construction site, and at all open excavations and tunnels to control access by unauthorized people. Fencing must be installed to meet or exceed OSHA requirements according to application.

2.2.3 Temporary Wiring

Provide temporary wiring in accordance with NFPA 241 and NFPA 70, Article 305-6(b), Assured Equipment Grounding Conductor Program. Include frequent inspection of all equipment and apparatus.

PART 3 EXECUTION

3.1 EMPLOYEE PARKING

Contractor employees will park privately owned vehicles in an area designated by the Contracting Officer. This area will be within reasonable walking distance of the construction site. Contractor employee parking must not interfere with existing and established parking requirements of the government installation.

3.2 AVAILABILITY AND USE OF UTILITY SERVICES

3.2.1 Temporary Utilities

Contractor shall provide temporary utilities required for construction.

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FINAL DESIGN

Materials may be new or used, shall be adequate for the required usage, shall not create unsafe conditions, and shall not violate applicable codes and standards.

3.2.1.1 Electricity

Contractor shall provide connections, sized to provide service required for power and lighting. Feeder and branch wiring with area distribution boxes shall be located so that power is available throughout the project site by use of power cords. 120/208 and 480 electrical volt feeder service is available. Lighting shall be provided by the Contractor. Electricity used will be furnished by the Government.

3.2.1.2 Water

Contractor shall make connections to existing facilities to provide water for construction purposes. Water used will be furnished by the Government.

3.2.1.3 Telephone Service

The Contractor shall provide telephone service for Contractor use. The Contractor shall pay costs of service. The Contractor shall coordinate with the Contracting Officer who will coordinate with NASA/DFRC telecommunications to allow system coordination for emergency 911 services.

3.2.2 Sanitation

Provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer and periodically empty wastes into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Obtain approval from the system owner prior to discharge into any municipal, district, or commercial sanitary sewer system. Any penalties and / or fines associated with improper discharge will be the responsibility of the Contractor. Coordinate with the Contracting Officer and follow station regulations and procedures when discharging into the station sanitary sewer system. Maintain these conveniences at all times without nuisance. In addition, the Contractor may also use existing sanitary facilities during the construction period.

3.2.3 Obstruction Lighting of Cranes

Provide a minimum of 2 aviation red or high intensity white obstruction lights on temporary structures (including cranes) over 100 feet above ground level. Light construction and installation must comply with FAA AC 70/7460-1. Lights must be operational during periods of reduced visibility, darkness, and as directed by the Contracting Officer.

3.2.4 Fire Protection

Provide temporary fire protection equipment for the protection of personnel and property during construction. Remove debris and flammable materials daily to minimize potential hazards.

3.3 TRAFFIC PROVISIONS

3.3.1 Maintenance of Traffic

- a. Conduct operations in a manner that will not close any thoroughfare or interfere in any way with traffic except with written permission of the

Contracting Officer at least 15 calendar days prior to the proposed modification date, and provide a Traffic Control Plan detailing the proposed controls to traffic movement for approval. The plan must be in accordance with State and local regulations and the MUTCD, Part VI. Contractor may move oversized and slow-moving vehicles to the worksite provided requirements of the highway authority have been met.

- b. Conduct work so as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times. Obtain approval from the Contracting Officer prior to starting any activity that will obstruct traffic.
- c. Provide, erect, and maintain, at contractors expense, lights, barriers, signals, passageways, detours, and other items, that may be required by the Life Safety Signage, overhead protection authority having jurisdiction.

### 3.3.2 Protection of Traffic

Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Provide and maintain, at Contractor's own expense, measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment the work, and the erection and maintenance of adequate warning, danger, and direction signs, as required by the State and local authorities having jurisdiction. Protect the traveling public from damage to person and property. Minimize the interference with public traffic on roads selected for hauling material to and from the site. Investigate the adequacy of existing roads and their allowable load limit. Contractor is responsible for the repair of any damage to roads caused by construction operations.

### 3.3.3 Dust Control

The Contractor shall provide dust control in accordance with Section 01 35 14.11 40 "Dryden Safety Requirements."

## 3.4 CONTRACTOR'S TEMPORARY FACILITIES

### 3.4.1 TEMPORARY STRUCTURES

Contractor-owned or leased trailers and temporary structures, where telephone service is installed and connected to the 911 emergency system, shall be identified by Government assigned numbers. The required building number shall be displayed on the structure on signs having brilliant blue background, white numbers, and of dimensions 18 inches by 36 inches. The signs shall be displayed on two sides of the structure at the upper left corner. The Contractor shall apply the number to the trailers within 14 days of placement, or sooner, if directed by the Government.

### 3.4.2 Safety

Protect the integrity of any installed safety systems or personnel safety devices. If entrance into systems serving safety devices is required, the Contractor must obtain prior approval from the Contracting Officer. If it is temporarily necessary to remove or disable personnel safety devices in order to accomplish contract requirements, provide alternative means of protection prior to removing or disabling any permanently installed safety

devices or equipment and obtain approval from the Contracting Officer.

#### 3.4.3 Administrative Field Offices

Provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

#### 3.4.4 Storage Area

Construct a view-obstructing temporary 6 foot high chain link fence around trailers and materials. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Do not place or store trailers, materials, or equipment outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the installation boundaries. Trailers, equipment, or materials must not be open to public view with the exception of those items which are in support of ongoing work on any given day. Do not stockpile materials outside the fence in preparation for the next day's work. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at the end of each work day.

#### 3.4.5 Appearance of Trailers

- a. Trailers utilized by the Contractor for administrative or material storage purposes must present a clean and neat exterior appearance and be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on installation property.
- b. Paint using suitable paint and maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal.

#### 3.4.6 Maintenance of Storage Area

- a. Keep fencing in a state of good repair and proper alignment. Grassed or unpaved areas, which are not established roadways, will be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways, should the Contractor elect to traverse them with construction equipment or other vehicles; gravel gradation will be at the Contractor's discretion.

#### 3.4.7 Security Provisions

Provide adequate outside security lighting at the Contractor's temporary facilities. The Contractor will be responsible for the security of its own equipment; in addition, the Contractor will notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

#### 3.4.8 Weather Protection of Temporary Facilities and Stored Materials

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

### 3.5 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, furnish and erect temporary project safety fencing at the work site. Maintain the safety fencing during the life of the contract and, upon completion and acceptance of the work, will become the property of the Contractor and be removed from the work site.

### 3.6 CLEANUP

Remove construction debris, waste materials, packaging material and the like from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways must be cleaned away. Store within the fenced area described above or at the supplemental storage area any materials resulting from demolition activities which are salvageable. Neatly stack stored materials not in trailers, whether new or salvaged.

### 3.7 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and any other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence that will become the property of the Contractor. Restore to the original or better condition, areas used by the Contractor for the storage of equipment or material, or other use. Gravel used to traverse grassed areas must be removed and the area restored to its original condition, including top soil and seeding as necessary.

-- End of Section --

SECTION 01 62 35

RECYCLED / RECOVERED MATERIALS

07/06

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.

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

40 CFR 247 Comprehensive Procurement Guideline for  
Products Containing Recovered Materials

1.2 OBJECTIVES

Government policy is to acquire, in a cost effective manner, items containing the highest percentage of recycled and recovered materials practicable consistent with maintaining a satisfactory level of competition without adversely affecting performance requirements or exposing suppliers' employees to undue hazards from the recovered materials. The Environmental Protection Agency (EPA) has designated certain items which must contain a specified percent range of recovered or recycled materials. EPA designated products specified in this contract comply with the stated policy and with the EPA guidelines. Make all reasonable efforts to use recycled and recovered materials in providing the EPA designated products and in otherwise utilizing recycled and recovered materials in the execution of the work.

1.3 EPA DESIGNATED ITEMS INCORPORATED IN THE WORK

Various sections of the specifications contain requirements for materials that have been designated by EPA as being products which are or can be made with recovered or recycled materials. These items, when incorporated into the work under this contract, shall contain at least the specified percentage of recycled or recovered materials unless adequate justification (non-availability) for non-use is provided. When a designated item is specified as an option to a non-designated item, the designated item requirements apply only if the designated item is used in the work.

1.4 EPA PROPOSED ITEMS INCORPORATED IN THE WORK

Products other than those designated by EPA are still being researched and are being considered for future Comprehensive Procurement Guideline (CPG) designation. It is recommended that these items, when incorporated in the work under this contract, contain the highest practicable percentage of recycled or recovered materials, provided specified requirements are also met.

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1.5 EPA LISTED ITEMS USED IN CONDUCT OF THE WORK BUT NOT INCORPORATED IN  
THE WORK

There are many products listed in 40 CFR 247 which have been designated or proposed by EPA to include recycled or recovered materials that may be used by the Contractor in performing the work but will not be incorporated into the work. These products include office products, temporary traffic control products, and pallets. It is recommended that these non-construction products, when used in the conduct of the work, contain the highest practicable percentage of recycled or recovered materials and that these products be recycled when no longer needed.

PART 2 TITLE

Not Used

PART 3 TITLE

Not Used

-- End of Section --

SECTION 01 74 19

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT  
01/07

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.

ASTM INTERNATIONAL (ASTM)

ASTM E 1609 (2001) Development and Implementation of a  
Pollution Prevention Program

1.2 GOVERNMENT POLICY

Government policy is to apply sound environmental principles in the design, construction and use of facilities. As part of the implementation of that policy: (1) practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction and demolition waste from landfills and incinerators and to facilitate their recycling or reuse. A minimum of 35 percent by weight of total project solid waste shall be diverted from the landfill in support of EO 13423, Section 2 and NASA Procedural Requirements (NPR) 8530.1.

1.3 MANAGEMENT

Develop and implement a waste management program in accordance with ASTM E 1609 and as specified. Take a pro-active, responsible role in the management of construction and demolition waste and require all subcontractors, vendors, and suppliers to participate in the effort. Construction and demolition waste includes products of demolition or removal, excess or unusable construction materials, packaging materials for construction products, and other materials generated during the construction process but not incorporated into the work. In the management of waste consideration shall be given to the availability of viable markets, the condition of the material, the ability to provide the material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates. The Contractor is responsible for implementation of any special programs involving rebates or similar incentives related to recycling of waste. Revenues or other savings obtained for salvage, or recycling accrue to the Contractor. Appropriately permit firms and facilities used for recycling, reuse, and disposal for the intended use to the extent required by federal, state, and local regulations. Also, provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00  
SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Waste Management Plan; G

SD-11 Closeout Submittals

Records

Salvage Material Records shall be submitted in accordance with Paragraph "SALVAGE MATERIALS AND EQUIPMENT"

1.5 MEETINGS

Conduct Construction Waste Management meetings. After award of the Contract and prior to commencement of work, schedule and conduct a meeting with the Contracting Officer to discuss the proposed Waste Management Plan and to develop a mutual understanding relative to the details of waste management. The requirements for this meeting may be fulfilled during the coordination and mutual understanding meeting outlined in Section 01 45 00.10 40 CONTRACTOR QUALITY CONTROL. At a minimum, environmental and waste management goals and issues shall be discussed at the following additional meetings:

- a. Pre-bid meeting.
- b. Preconstruction meeting.
- c. Regular on-site QC meetings.
- d. Work safety meetings.

1.6 WASTE MANAGEMENT PLAN

A waste management plan shall be submitted within 15 days after notice to proceed and not less than 10 days before the preconstruction meeting. The plan shall demonstrate how the project waste diversion goal shall be met and shall include the following:

- a. Name of individuals on the Contractor's staff responsible for waste prevention and management.
- b. Actions that will be taken to reduce solid waste generation, including coordination with subcontractors to ensure awareness and participation.
- c. Description of the regular meetings to be held to address waste management.
- d. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas on site and equipment to be used for processing, sorting, and temporary storage of wastes.
- e. Characterization, including estimated types and quantities, of the waste to be generated.
- f. Name of landfill and/or incinerator to be used and the estimated costs for use, assuming that there would be no salvage or recycling on the project.

- g. Identification of local and regional reuse programs, including non-profit organizations such as schools, local housing agencies, and organizations that accept used materials such as materials exchange networks and Habitat for Humanity. Include the name, location, and phone number for each reuse facility to be used, and provide a copy of the permit or license for each facility.
- h. List of specific waste materials that will be salvaged for resale, salvaged and reused on the current project, salvaged and stored for reuse on a future project, or recycled. Recycling facilities that will be used shall be identified by name, location, and phone number, including a copy of the permit or license for each facility.
- i. Identification of materials that cannot be recycled/reused with an explanation or justification, to be approved by the Contracting Officer.
- j. Description of the means by which any waste materials identified in item (h) above will be protected from contamination.
- k. Description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site).
- l. Anticipated net cost savings determined by subtracting Contractor program management costs and the cost of disposal from the revenue generated by sale of the materials and the incineration and/or landfill cost avoidance.

Revise and resubmit Plan as required by the Contracting Officer. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations or meeting project cumulative waste diversion requirement. Distribute copies of the Waste Management Plan to each subcontractor, the Quality Control Manager, and the Contracting Officer.

#### 1.7 RECORDS

Records shall be maintained to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. The records shall be made available to the Contracting Officer during construction, and a copy of the records shall be delivered to the Contracting Officer upon completion of the construction.

#### 1.8 SALVAGE MATERIALS AND EQUIPMENT

All items of materials designated by the Contracting Officer to be salvaged shall remain the property of the Government. Salvage Material Records shall be made available to the Contracting Officer during construction, and a copy of the records shall be delivered to the Contracting Officer upon completion of the construction. Salvage items shall be marked, segregated, itemized, delivered, and off-loaded by the Contractor at the storage area near Building 4876.

The Contractor shall maintain adequate property control records for all materials or equipment designated as salvage. These records may be in accordance with the Contractor's system of property control, if approved by

the Contracting Officer. The Contractor shall be responsible for adequate storage and protection of salvaged materials and equipment and shall replace, at no cost to the Government, salvage materials and equipment broken or damaged during salvage operations.

#### 1.9 COLLECTION

Separate, store, protect, and handle at the site identified recyclable and salvageable waste products in a manner that maximizes recyclability and salvageability of identified materials. Provide the necessary containers, bins and storage areas to facilitate effective waste management and clearly and appropriately identify them. Provide materials for barriers and enclosures around recyclable material storage areas which are nonhazardous and recyclable or reusable. Locate out of the way of construction traffic. Provide adequate space for pick-up and delivery and convenience to subcontractors. Recycling and waste bin areas are to be kept neat and clean, and recyclable materials shall be handled to prevent contamination of materials from incompatible products and materials. Clean contaminated materials prior to placing in collection containers. Use cleaning materials that are nonhazardous and biodegradable. Handle hazardous waste and hazardous materials in accordance with applicable regulations and coordinate with Section 01 35 14.11 40 DRYDEN SAFETY REQUIREMENTS.

Separate materials by one of the following methods:

##### 1.9.1 Source Separated Method.

Waste products and materials that are recyclable shall be separated from trash and sorted as described below into appropriately marked separate containers and then transported to the respective recycling facility for further processing. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process). Separate materials into the following category types as appropriate to the project waste and to the available recycling and reuse programs in the project area:

- a. Land clearing debris.
- b. Asphalt.
- c. Concrete and masonry.
- d. Metal (e.g. banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized, stainless steel, aluminum, copper, zinc, lead brass, bronze).
  - (1) Ferrous.
  - (2) Non-ferrous.
- e. Wood (nails and staples allowed).
- f. Debris.
- g. Glass (colored glass allowed).
- h. Paper.

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- (1) Bond.
- (2) Newsprint.
- (3) Cardboard and paper packaging materials.

i. Plastic.

- (1) Type 1: Polyethylene Terephthalate (PET, PETE).
- (2) Type 2: High Density Polyethylene (HDPE).
- (3) Type 3: Vinyl (Polyvinyl Chloride or PVC).
- (4) Type 4: Low Density Polyethylene (LDPE).
- (5) Type 5: Polypropylene (PP).
- (6) Type 6: Polystyrene (PS).
- (7) Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

j. Gypsum.

k. Non-hazardous paint and paint cans.

l. Carpet.

m. Ceiling tiles.

n. Insulation.

o. Beverage containers.

1.9.2 Commingled Method.

Waste products and recyclable materials shall be placed into a single container and then transported to a recycling facility where the recyclable materials are sorted and processed.

1.9.3 Other Methods.

Other methods proposed by the Contractor may be used when approved by the Contracting Officer.

1.10 DISPOSAL

Control accumulation of waste materials and trash. Recycle or dispose of collected materials off-site at intervals approved by the Contracting Officer and in compliance with waste management procedures. Except as otherwise specified in other sections of the specifications, disposal shall be in accordance with the following:

1.10.1 Reuse.

First consideration shall be given to salvage for reuse since little or no

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re-processing is necessary for this method, and less pollution is created when items are reused in their original form. Coordinate reuse with the Contracting Officer. Sale or donation of waste suitable for reuse shall be considered.

1.10.2 Recycle.

Waste materials not suitable for reuse, but having value as being recyclable, shall be made available for recycling. All fluorescent lamps, HID lamps, and mercury-containing thermostats removed from the site shall be recycled. Arrange for timely pickups from the site or deliveries to recycling facilities in order to prevent contamination of recyclable materials.

1.10.3 Waste.

Materials with no practical use or economic benefit shall be disposed at a landfill or incinerator.

1.10.4 Return

Set aside and protect misdelivered and substandard products and materials and return to supplier for credit.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used. -- End of Section --

SECTION 01 75 00.00 40

DRYDEN STARTUP AND COMMISSIONING

10/06

PART 1 GENERAL

1.1 SUMMARY

Requirements of this Section apply to, and are a component part of, each section of the specifications.

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Verification of Prior Experience; G and expertise with similar project scope

Documentation of Manufacturer's Prior Experience; G and expertise with similar project materials and systems

Quality Control Plan; G including testing and start-up schedule

Manufacturer's Sample Warranty and Operation and Maintenance Data; G

Provide Evidence that products used within this specification are manufactured in the United States.

SD-02 Shop Drawings

Drawings, Diagrams and Schedules; G specifically prepared to illustrate some portion of the work

Diagrams and Instructions; G from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project

Drawings; G prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated

SD-03 Product Data

Catalog cuts; G, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work

Samples of warranty language; G when the contract requires product warranties

SD-05 Design Data

Design Calculations; G, mix designs, analyses or other data

pertaining to a part of work

SD-06 Test Reports

Factory Tests; G  
Functional Field Test; G  
Final Acceptance Test; G

Test Procedures; G

SD-07 Certificates

Qualification of Manufacturer; G

Qualification of Installer

Certify that the installer meets requirements specified under paragraph entitled "Qualification of Installer."

SD-08 Manufacturer's Instructions

Manufacturer's Administrative Requirements; G

Demonstration and Training Information; G

Manufacturer's Procedural Requirements; G for initial checkout, startup, and adjusting to ensure safe operation during acceptance testing and commissioning.

SD-09 Manufacturer's Field Reports

Documentation of the Testing and Verification Actions; G taken by manufacturer's representative at the job site, or on a sample taken from the job site, on a portion of the work, during installation, to confirm compliance with manufacturer's standards or instructions

SD-10 Operation and Maintenance Data

Refer to Section 01 78 23 OPERATION AND MAINTENANCE DATA for detailed requirements and procedures.

Operation and Maintenance Data provided by the manufacturer to ensure the safe and efficient operation, maintenance and repair of the system or equipment provided.

Safety and Security Data or Posters provided by the manufacturer

1.2.1 Preconstruction and Pre-Testing Requirements

The Contractor is responsible to deliver equipment and services to meet the requirements and specifications of their respective contract. All equipment must be free of latent manufacturing and installation defects. Acceptance criteria must be clearly defined to establish required baselines for future maintenance and life-cycle evaluations. The Government reserves the option to elect performance of acceptance testing by internal personnel, or a designated third party. Regardless of who performs the acceptance testing, the requirements of acceptance must be met by the Contractor.

Submit the following for review and approval prior to the commencement of work and any testing, whether such testing is on site or elsewhere:

- a. Verification of prior experience and expertise with similar project scope
- b. Documentation of manufacturer's prior experience and expertise with similar project materials and systems
- c. Quality control plan
- d. Manufacturer's Sample Warranty and Operation and Maintenance Data, with details regarding start-up procedures
- e. Manufacturer's administrative requirements
- f. Manufacturer's procedural requirements
- g. Demonstration and Training Information

Contractor must submit the following certifications:

- a. Provide evidence that products used within this specification are manufactured in the United States.
- b. Qualification of Manufacturer, including current licenses and insurance.
- c. Qualification of Installer, including licenses and insurance.

#### 1.2.2 Shop Drawings and Diagrams

Submit the following shop drawings, record drawings, and diagrams as required to correctly execute the installation of the work:

- a. Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work
- b. Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project
- c. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated

#### 1.2.3 Product and Design Data

Contractor must submit all product data and any design calculations, mix designs, analyses or other data pertaining to a part of work to ensure a complete functional installation; including, but not limited to:

- a. Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work
- b. Samples of warranty language when the contract requires product warranties

- c. Operation and Maintenance Data provided by the manufacturer to ensure the safe and efficient operation, maintenance and repair of the system or equipment provided.
- d. Safety and Security Data or posters provided by the manufacturer to be posted in a conspicuous visible location for operational and maintenance personnel.

#### 1.2.4 Tests Required

Perform tests to verify proper functioning of fire protection, fire suppression, HVAC, compressed air, electrical switchgear, protective relaying, fluid and gas systems, pump/motor combinations, boiler systems, hydraulic and pneumatic control, condition/performance monitoring systems, energy control and monitoring systems, and other assemblies and components that need to be tested as an interrelated whole.

##### 1.2.4.1 STARTING OF SYSTEMS

The Contractor shall perform formal functional tests with full documentation using the approved recording form. Test procedures and recording form that document the test steps shall be submitted for approval to the Contracting Officer twenty one (21) calendar days prior to the proposed test date. The procedure shall consist of step by step instruction to verify system parameters, components, and functions.

The Contractor shall perform an "in-house" test to verify that the system and components have been properly installed and are functioning properly. Test shall be performed in the presence of the Contracting Officer. Test shall be completed and found acceptable when one full test has been performed without component or system malfunction. The contractor shall submit a Functional Test Report documenting the actual steps and results of the test.

##### 1.2.4.2 Factory Tests

Submit certified copies of required tests performed at the factory to verify proper build. These test results will be used in the "Final Acceptance Test" section to verify no shipping damage and proper installation. Government may request to witness Factory Test prior to shipping, Contractor shall give minimum 14 calendar days advance notice to permit Government travel time.

##### 1.2.4.3 Functional Field Test

Contractor must perform functional field test(s) to verify that the system and components have been properly installed and are functioning properly. Perform test(s) in the presence of the Contracting Officer. Acceptance will be issued when system has performed per other sections and referenced industry standards.

Coordinate and submit documentation of the testing and verification actions taken by manufacturer's representative at the job site, or on a sample taken from the job site, on a portion of the work, during installation, to confirm compliance with manufacturer's standards or instructions.

##### 1.2.4.4 Final Acceptance Test

Perform a formal test with full documentation using the approved recording

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form. Contracting Officer will witness this test and issue a written final acceptance. Provide final test data to the Contracting Officer with a cover letter clearly marked with the system name, date, and the words " Final Test Data - Forward to the Systems Engineer/Condition Monitoring Office/Predictive Testing Group for inclusion in the Maintenance Database."

1.2.4.5 Test Procedures

Submit test procedure and recording forms that document the test steps for approval to the Contracting Officer 30 calendar days prior to the proposed test date. Procedure must clearly state step by step instruction to verify system parameters, components, and functions.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 78 00

CLOSEOUT SUBMITTALS  
05/10

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.

ASTM INTERNATIONAL (ASTM)

ASTM E 1971 (2005) Stewardship for the Cleaning of  
Commercial and Institutional Buildings

GREEN SEAL (GS)

GS-37 (2000; R 2009) Industrial and  
Institutional Cleaners

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL  
PROCEDURES:

SD-03 Product Data

As-Built Record of Equipment and Materials  
Warranty Management Plan  
Warranty Tags  
Final Cleaning  
Spare Parts Data

SD-08 Manufacturer's Instructions

Preventive Maintenance schedule and instructions  
Condition Monitoring (Predictive Testing) schedule and instructions  
Inspection schedule and instructions  
Instructions to be Posted

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

SD-11 Closeout Submittals

As-Built Drawings  
Certification of EPA Designated Items; G  
NASA Form NF1046

1.3 PROJECT RECORD DOCUMENTS

1.3.1 As-Built Drawings

Drawings showing final as-built conditions of the project. This paragraph

covers complete record drawings, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working record drawings," "as-built drawings" and "final record drawings" refer to contract drawings which are revised to be used for final record drawings showing as-built conditions. The red-lined drawings must consist of 2 sets of completed final as-built original drawings, and the approved deviation documentation.

#### 1.3.1.1 Working Record and Final Record Drawings

Revise 2 sets of paper drawings by red-line process to show the as-built conditions during the execution of the project. Keep these working as-built marked drawings current on a weekly basis and at least one set available on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction must be accurately and neatly recorded as they occur by means of details and notes. Prepare final record (as-built) drawings after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The working as-built marked prints and final record (as-built) drawings will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor prior to submission of each monthly pay estimate. Show on the working and final record drawings, but not limited to, the following information:

- a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the depth below the surface of each run. In addition, a GPS survey shall be completed by Contractor when required by contract drawings.
- b. The location and dimensions of any changes within the building structure.
- c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.
- d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.
- e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.
- f. Changes or modifications which result from the final inspection.
- g. Where contract drawings or specifications present options, show only the option selected for construction on the final as-built prints.
- h. If borrow material for this project is from sources on Government

property, or if Government property is used as a spoil area, furnish a contour map of the final borrow pit/spoil area elevations.

- i. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.
- j. Modifications (include within change order price the cost to change working and final record drawings to reflect modifications) and compliance with the following procedures.
  - (1) Follow directions in the modification for posting descriptive changes.
  - (2) Place a Modification Delta at the location of each deletion.
  - (3) For new details or sections which are added to a drawing, place a Modification Delta by the detail or section title.
  - (4) For minor changes, place a Modification Delta by the area changed on the drawing (each location).
  - (5) For major changes to a drawing, place a Modification Delta by the title of the affected plan, section, or detail at each location.
  - (6) For changes to schedules or drawings, place a Modification Delta either by the schedule heading or by the change in the schedule.
  - (7) The Modification Delta size shall be 1/2 inch diameter unless the area where the delta is to be placed is crowded. Smaller size delta shall be used for crowded areas.

#### 1.3.1.2 Drawing Preparation

Modify the record drawings as needed to correctly show the features of the project as constructed by bringing the contract set into agreement with approved working as-built prints, and adding such additional drawings as may be necessary. These working as-built marked prints must be neat, legible and accurate. These drawings are part of the permanent records of this project and must be returned to the Contracting Officer after approval by the Government. Any drawings damaged or lost by the Contractor must be satisfactorily replaced by the Contractor at no expense to the Government.

#### 1.3.1.3 Payment

No separate payment will be made for record drawings required under this contract, and all costs accrued in connection with such drawings are considered a subsidiary obligation of the Contractor.

#### 1.3.2 As-Built Record of Equipment and Materials

Furnish two (2) copies of preliminary record of equipment and materials used on the project 15 days prior to final inspection. This preliminary submittal will be reviewed and returned 2 days after final inspection with Government comments. Submit two (2) sets of final record of equipment and materials 10 days after final inspection. Key the designations to the related area depicted on the contract drawings. At a minimum, list the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA

Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used
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1.3.3 Final Approved Shop Drawings

Furnish final approved project shop drawings 30 days after transfer of the completed facility.

1.3.4 Construction Contract Specifications

Furnish final record (as-built) construction contract specifications, including modifications thereto, 30 days after transfer of the completed facility.

1.3.5 Real Property Equipment

Furnish a list of installed equipment furnished under this contract. Include all information usually listed on manufacturer's name plate. In the "EQUIPMENT-IN-PLACE LIST" include, as applicable, the following for each piece of equipment installed: description of item, location (by room number), date installed, equipment cost, model number, serial number, capacity, name and address of manufacturer, name and address of equipment supplier, condition, spare parts list, manufacturer's catalog, estimated service life, and warranty. Furnish a draft list at time of transfer. Furnish the final list 30 days after transfer of the completed facility.

1.4 SPARE PARTS DATA

Submit two copies of the Spare Parts Data list.

- a. Indicate manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair. List those items that may be standard to the normal maintenance of the system.
- b. The Government will identify what equipment for which to provide spare parts and the number of spare parts to provide. Supply this number of items of each part for spare parts inventory as requested by the Government. Provision of spare parts does not relieve the Contractor of responsibilities listed under the contract guarantee provisions.

1.5 PREVENTIVE MAINTENANCE

Submit Preventive Maintenance, Condition Monitoring (Predictive Testing) and Inspection schedules with instructions that state when systems should be retested.

- a. Define the anticipated length of each test, test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a signoff blank for the Contractor and Contracting Officer for each test feature; e.g., gpm, rpm, psi. Include a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration,

adjustments, cleaning, or special system notes. Delineate procedures for preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize corrective maintenance and repair.

- b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

#### 1.6 CERTIFICATION OF EPA DESIGNATED ITEMS

Submit the Certification of EPA Designated Items as required by FAR 52.223-9, "Certification and Estimate of Percentage of Recovered Material Content for EPA Designated Items". Include on the certification form the following information: project name, project number, Contractor name, license number, Contractor address, and certification. The certification will read as follows and be signed and dated by the Contractor. "I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current EPA standards for recycled/recovered materials content. The following exemptions may apply to the non-procurement of recycled/recovered content materials: 1) The product does not meet appropriate performance standards; 2) The product is not available within a reasonable time frame; 3) The product is not available competitively (from two or more sources); 4) The product is only available at an unreasonable price (compared with a comparable non-recycled content product)." Record each product used in the project that has a requirement or option of containing recycled content in accordance with Section 01 62 35 RECYCLED/RECOVERED MATERIALS, noting total price, total value of post-industrial recycled content, total value of post-consumer recycled content, exemptions (1, 2, 3, or 4, as indicated), and comments. Recycled content values may be determined by weight or volume percent, but must be consistent throughout.

#### 1.7 WARRANTY MANAGEMENT

##### 1.7.1 Warranty Management Plan

Develop a warranty management plan which contains information relevant to the clause Warranty of Construction. At least 30 days before the planned pre-warranty conference, submit two sets of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan must be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase must be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Assemble approved information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period will begin on the date of project acceptance and continue for the full product warranty period. Include within the warranty management plan, but not limited to, the following:

- a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the contractors, subcontractors,

manufacturers or suppliers involved.

- b. Furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.
- c. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.
- d. A list for each warranted equipment, item, feature of construction or system indicating:
  - (1) Name of item.
  - (2) Model and serial numbers.
  - (3) Location where installed.
  - (4) Name and phone numbers of manufacturers or suppliers.
  - (5) Names, addresses and telephone numbers of sources of spare parts.
  - (6) Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have extended warranties must be indicated with separate warranty expiration dates.
  - (7) Cross-reference to warranty certificates as applicable.
  - (8) Starting point and duration of warranty period.
  - (9) Summary of maintenance procedures required to continue the warranty in force.
  - (10) Cross-reference to specific pertinent Operation and Maintenance manuals.
  - (11) Organization, names and phone numbers of persons to call for warranty service.
  - (12) Typical response time and repair time expected for various warranted equipment.
- e. The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.
- f. Procedure and status of tagging of all equipment covered by extended warranties.
- g. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

#### 1.7.2 Performance Bond

The Contractor's Performance Bond must remain effective throughout the construction performance period.

#### 1.7.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty will be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion

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inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, be continuously available, and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

1.7.4 Warranty Tags

At the time of installation, tag each warranted item with a durable, oil and water resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Also, submit two record copies of the warranty tags showing the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

- a. Type of product/material\_\_\_\_\_.
- b. Model number\_\_\_\_\_.
- c. Serial number\_\_\_\_\_.
- d. Contract number\_\_\_\_\_.
- e. Warranty period\_\_\_\_\_ from\_\_\_\_\_ to\_\_\_\_\_.
- f. Inspector's signature\_\_\_\_\_.
- g. Construction Contractor\_\_\_\_\_.
- Address\_\_\_\_\_.
- Telephone number\_\_\_\_\_.
- h. Warranty contact\_\_\_\_\_.
- Address\_\_\_\_\_.
- Telephone number\_\_\_\_\_.
- j. WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.

1.8 OPERATION AND MAINTENANCE MANUALS

Submit 2 copies of the project operation and maintenance manuals 30 calendar days prior to testing the system involved. Update and resubmit data for final approval no later than 30 calendar days prior to contract completion.

1.8.1 Configuration

Operation and Maintenance Manuals must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions. Bind information in manual format and grouped by technical sections. Test data must be legible

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and of good quality. Light-sensitive reproduction techniques are acceptable provided finished pages are clear, legible, and not subject to fading. Pages for vendor data and manuals must be bound in 3-ring, loose-leaf binders. Organize data by separate index and tabbed sheets, in a loose-leaf binder. Binder must lie flat with printed sheets that are easy to read. Caution and warning indications must be clearly labeled.

1.8.2 Training and Instruction

Submit classroom and field instructions in the operation and maintenance of systems equipment where required by the technical provisions. These services must be directed by the Contractor, using the manufacturer's factory-trained personnel or qualified representatives. Contracting Officer will be given 7 calendar days written notice of scheduled instructional services. Instructional materials belonging to the manufacturer or vendor, such as lists, static exhibits, and visual aids, must be made available to the Contracting Officer.

1.9 WORK AREA CLEANUP

Provide final cleaning of contract work area in accordance with ASTM E 1971 and submit two copies of the listing of completed final clean-up items. Leave premises "broom clean." Comply with GS-37 for general purpose cleaning and bathroom cleaning. Use only nonhazardous cleaning materials, including natural cleaning materials, in the final cleanup. Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Remove waste and surplus materials, rubbish and construction facilities from the site. Recycle, salvage, and return construction and demolition waste from project in accordance with the Waste Management Plan. Promptly and legally transport and dispose of any trash. Do not burn, bury, or otherwise dispose of trash on the project site.

1.10 REAL PROPERTY TRANSFER DOCUMENTATION

Near the completion of Project, but not later than final transfer, complete and submit an accounting of all installed property with NASA Form NF1046 "Transfer and/or Notification of Acceptance of Accountability of Real Property."

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

07/06

PART 1 GENERAL

1.1 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system, stressing and enhancing the importance of system interactions, troubleshooting, and long-term preventive maintenance and operation. The subcontractors shall compile and prepare data and deliver to the Contractor prior to the training of Government personnel. The Contractor shall compile and prepare aggregate O&M data including clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01 33 00 SUBMITTAL PROCEDURES.

1.1.1 Package Quality

Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

1.1.2 Package Content

Data package content shall be as shown in the paragraph titled "Schedule of Operation and Maintenance Data Packages." Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows. Commissioned items without a specified data package requirement in the individual technical sections shall use Data Package 4. Commissioned items with a Data Package 1 or 2 requirement shall use instead Data Package 4.

1.1.3 Changes to Submittals

Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M Data. Changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data, shall be submitted by the Contractor within 30 calendar days of the notification of this change requirement.

1.1.4 Review and Approval

The Contractor's Commissioning Authority (CA) shall review the commissioned systems and equipment submittals for completeness and applicability. The CA shall verify that the systems and equipment provided meet the requirements of the Contract documents and design intent, particularly as they relate to functionality, energy performance, water performance, maintainability, sustainability, system cost, indoor environmental quality, and local environmental impacts. The CA shall communicate deficiencies to the Contracting Officer. Upon a successful review of the corrections, the CA shall recommend approval and acceptance of these O&M

manuals to the Contracting Officer. This work shall be in addition to the normal review procedures for O&M data.

## 1.2 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

### 1.2.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

#### 1.2.1.1 Safety Precautions

List personnel hazards and equipment or product safety precautions for all operating conditions.

#### 1.2.1.2 Operator Prestart

Include procedures required to install, set up, and prepare each system for use.

#### 1.2.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

#### 1.2.1.4 Normal Operations

Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.

#### 1.2.1.5 Emergency Operations

Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations and zones or portions of systems controlled.

#### 1.2.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gage readings.

#### 1.2.1.7 Environmental Conditions

Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

### 1.2.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair for the installed model and features of each system. Include potential environmental and indoor air

quality impacts of recommended maintenance procedures and materials.

#### 1.2.2.1 Lubrication Data

Include preventive maintenance lubrication data, in addition to instructions for lubrication provided under paragraph titled "Operator Service Requirements":

- a. A table showing recommended lubricants for specific temperature ranges and applications.
- b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.
- c. A Lubrication Schedule showing service interval frequency.

#### 1.2.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

#### 1.2.3 Corrective Maintenance (Repair)

Include manufacturer's recommended procedures and instructions for correcting problems and making repairs.

##### 1.2.3.1 Troubleshooting Guides and Diagnostic Techniques

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

##### 1.2.3.2 Wiring Diagrams and Control Diagrams

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

##### 1.2.3.3 Maintenance and Repair Procedures

Include instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

##### 1.2.3.4 Removal and Replacement Instructions

Include step-by-step procedures and a list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include

a combination of text and illustrations.

#### 1.2.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

#### 1.2.4 Corrective Maintenance Work-Hours

Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.

#### 1.2.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

##### 1.2.5.1 Product Submittal Data

Provide a copy of all SD-03 Product Data submittals required in the applicable technical sections.

##### 1.2.5.2 Manufacturer's Instructions

Provide a copy of all SD-08 Manufacturer's Instructions submittals required in the applicable technical sections.

##### 1.2.5.3 O&M Submittal Data

Provide a copy of all SD-10 Operation and Maintenance Data submittals required in the applicable technical sections.

##### 1.2.5.4 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog

##### 1.2.5.5 Warranty Information

List and explain the various warranties and clearly identify the servicing

and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

#### 1.2.5.6 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

#### 1.2.5.7 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

#### 1.2.5.8 Testing and Performance Data

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms.

#### 1.2.5.9 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

### 1.3 TYPES OF INFORMATION REQUIRED IN CONTROLS O&M DATA PACKAGES

Include Data Package 5 and the following for control systems:

- a. Narrative description on how to perform and apply all functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.
- b. Full as-built sequence of operations.
- c. Copies of all checkout tests and calibrations performed by the Contractor (not Cx tests).
- d. Full points list. A listing of rooms shall be provided with the following information for each room:
  - (1) Floor
  - (2) Room number
  - (3) Room name
  - (4) Air handler unit ID

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- (5) Reference drawing number
- (6) Air terminal unit tag ID
- (7) Heating and/or cooling valve tag ID
- (8) Minimum cfm
- (9) Maximum cfm
- e. Full print out of all schedules and set points after testing and acceptance of the system.
- f. Full as-built print out of software program.
- g. Electronic copy on disk or CD of the entire program for this facility.
- h. Marking of all system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

1.4 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:

1.4.1 Data Package 1

- a. Safety precautions
- b. Cleaning recommendations
- c. Maintenance and repair procedures
- d. Spare parts and supply list
- e. Warranty information
- f. Contractor information

1.4.2 Data Package 2

- a. Safety precautions
- b. Normal operations
- c. Environmental conditions
- d. Lubrication data
- e. Preventive maintenance plan and schedule
- f. Cleaning recommendations
- g. Maintenance and repair procedures
- h. Removal and replacement instructions
- i. Spare parts and supply list

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- j. Parts identification
- k. Warranty information
- l. Contractor information

1.4.3 Data Package 3

- a. Safety precautions
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Emergency operations
- f. Environmental conditions
- g. Lubrication data
- h. Preventive maintenance plan and schedule
- i. Cleaning recommendations
- j. Troubleshooting guides and diagnostic techniques
- k. Wiring diagrams and control diagrams
- l. Maintenance and repair procedures
- m. Removal and replacement instructions
- n. Spare parts and supply list
- o. Product submittal data
- p. O&M submittal data
- q. Parts identification
- r. Warranty information
- s. Testing equipment and special tool information
- t. Testing and performance data
- u. Contractor information

1.4.4 Data Package 4

- a. Safety precautions
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations

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- e. Emergency operations
  - f. Operator service requirements
  - g. Environmental conditions
  - h. Lubrication data
  - i. Preventive maintenance plan and schedule
  - j. Cleaning recommendations
  - k. Troubleshooting guides and diagnostic techniques
  - l. Wiring diagrams and control diagrams
  - m. Maintenance and repair procedures
  - n. Removal and replacement instructions
  - o. Spare parts and supply list
  - p. Corrective maintenance man-hours
  - q. Product submittal data
  - r. O&M submittal data
  - s. Parts identification
  - t. Warranty information
  - u. Personnel training requirements
  - v. Testing equipment and special tool information
  - w. Testing and performance data
  - x. Contractor information
- 1.4.5 Data Package 5
- a. Safety precautions
  - b. Operator prestart
  - c. Start-up, shutdown, and post-shutdown procedures
  - d. Normal operations
  - e. Environmental conditions
  - f. Preventive maintenance plan and schedule
  - g. Troubleshooting guides and diagnostic techniques
  - h. Wiring and control diagrams

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- i. Maintenance and repair procedures
- j. Removal and replacement instructions
- k. Spare parts and supply list
- l. Product submittal data
- m. O&M submittal data
- n. Parts identification
- o. Warranty information
- p. Testing equipment and special tool information
- q. Testing and performance data
- r. Contractor information
- s. Manufacturer's instructions

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 02 41 00

DEMOLITION  
05/10

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.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

ARI Guideline K (2005) Guideline for Containers for Recovered Non-Flammable Fluorocarbon Refrigerants

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 145 (1991; R 2004) Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

AASHTO T 180 (2001; R 2004) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457-mm (18-in) Drop

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.6 (2006) Safety Requirements for Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2008; Change 1-2010; Change 3-2010; Errata 1-2010) Safety and Health Requirements Manual

U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA 4145.25 (June 2000) Storage and Handling of Liquefied and Gaseous Compressed Gases and Their Full and Empty Cylinders

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 4000.25-1-M (2006; Notice 1) Requisitioning and Issue Procedures

MIL-STD-129 (Rev P; Notice 3; Change 4) Military Marking for Shipment and Storage

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

40 CFR 61	National Emission Standards for Hazardous Air Pollutants
40 CFR 82	Protection of Stratospheric Ozone
49 CFR 173.301	Shipment of Compressed Gases in Cylinders and Spherical Pressure Vessels

1.2 GENERAL REQUIREMENTS

Do not begin demolition until authorization is received from the Contracting Officer. The work of this section is to be performed in a manner that maximizes salvage and recycling of materials. Remove rubbish and debris from the station daily; do not allow accumulations inside or outside the buildings or on airfield pavements. The work includes demolition and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-07 Certificates

Notifications; G  
Demolition plan; G

Proposed salvage, demolition and removal procedures for approval before work is started.

SD-11 Closeout Submittals

Receipts

Receipts or bills of lading, as specified.

1.4 REGULATORY AND SAFETY REQUIREMENTS

Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSE/SAFE A10.6.

1.4.1 Notifications

1.4.1.1 General Requirements

Furnish timely notification of demolition and renovation projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the Regional Office of the United States Environmental Protection Agency (USEPA), State's environmental protection agency, local

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air pollution control district/agency, and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61, Subpart M.

1.4.2 Receipts

Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS) shipped to the Defense Depot, Richmond, Virginia.

1.5 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris to occupied portions of the building, on airfield pavements, and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, flooding or pollution. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to aircraft.

1.6 PROTECTION

1.6.1 Traffic Control Signs

Where pedestrian and driver or aircraft safety is endangered in the area of removal work, use traffic barricades with flashing lights. Anchor barricades in a manner to prevent displacement by wind, jet or prop blast. Notify the Contracting Officer prior to beginning such work.

1.6.2 Existing Conditions Documentation

Before beginning any demolition work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing work in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, the location and extent of cracks and other damage, and description of surface conditions that exist prior to starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of the work, and note these outages on the record document.

1.6.3 Items to Remain in Place

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements or pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

1.6.4 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or

necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove dust, dirt, and debris from work areas daily.

#### 1.6.5 Weather Protection

For portions of the building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas.

#### 1.6.6 Trees

Protect trees within the project site which might be damaged during demolition, and which are indicated to be left in place, by a 6 foot high fence. Erect and secure fence a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Replace any tree designated to remain that is damaged during the work under this contract with like-kind or as approved by the Contracting Officer.

#### 1.6.7 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition operations. Prior to start of work, utilities serving each area of alteration or removal will be shut off by the Government and disconnected and sealed by the Contractor.

#### 1.6.8 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

#### 1.6.9 Protection of Personnel

Before, during and after the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

#### 1.7 BURNING

The use of burning at the project site for the disposal of refuse and

debris will not be permitted

#### 1.8 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Items to be relocated which are damaged by the Contractor shall be repaired or replaced with new undamaged items as approved by the Contracting Officer.

#### 1.9 REQUIRED DATA

Prepare a Demolition Plan. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, and airfield lighting, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Coordinate with Waste Management Plan. Provide procedures for safe conduct of the work in accordance with EM 385-1-1. Plan shall be approved by Contracting Officer prior to work beginning.

#### 1.10 ENVIRONMENTAL PROTECTION

Comply with the Environmental Protection Agency requirements specified.

#### 1.11 USE OF EXPLOSIVES

Use of explosives will not be permitted.

### PART 2 PRODUCTS

#### 2.1 FILL MATERIAL

Comply with excavating, backfilling, and compacting procedures for soils used as backfill material to fill basements, voids, depressions or excavations resulting from demolition or deconstruction of structures. Fill material shall be waste products from demolition or deconstruction until all waste appropriate for this purpose is consumed.

Fill material must conform to the definition of satisfactory soil material as defined in AASHTO M 145, Soil Classification Groups A-1, A-2-4, A-2-5 and A-3. In addition, fill material must be free from roots and other organic matter, trash, debris, frozen materials, and stones larger than 2 inches in any dimension.

Proposed fill material must be sampled and tested by an approved soil testing laboratory, as follows:

Soil classification	AASHTO M 145
Moisture-density relations	AASHTO T 180, Method B or D

### PART 3 EXECUTION

#### 3.1 EXISTING FACILITIES TO BE REMOVED

##### 3.1.1 Structures

- a. Remove existing structures indicated to be removed completely. Interior walls, other than retaining walls and partitions, shall be

removed to 2 feet below grade or to top of concrete slab on ground. Basement slabs shall be broken up to permit drainage. Sidewalks, curbs, gutters and street light bases shall be removed as indicated.

b. Demolish structures in a systematic manner from the top of the structure to the ground. Complete demolition work above each tier or floor before the supporting members on the lower level are disturbed. Demolish concrete and masonry walls in small sections. Remove structural framing members and lower to ground by means of derricks, platforms hoists, or other suitable methods as approved by the Contracting Officer.

c. Locate demolition equipment throughout the structure and remove materials so as to not impose excessive loads to supporting walls, floors, or framing.

d. Building, or the remaining portions thereof, not exceeding 80 feet in height may be demolished by the mechanical method of demolition.

### 3.1.2 Utilities and Related Equipment

#### 3.1.2.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

#### 3.1.2.2 Disconnecting Existing Utilities

Remove existing utilities, as indicated and/or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area. Remove meters and related equipment and deliver to a location on the station in accordance with instructions of the Contracting Officer.

#### 3.1.3 Chain Link Fencing

Remove chain link fencing, gates and other related salvaged items scheduled for removal and transport to designated areas. Remove gates as whole units. Cut chain link fabric to 25 foot lengths and store in rolls off the ground.

#### 3.1.4 Paving and Slabs

Remove by sawcutting concrete and asphaltic concrete paving and slabs including aggregate base, as indicated. Provide neat sawcuts at limits of pavement removal as indicated.

#### 3.1.5 Masonry

Sawcut and remove masonry so as to prevent damage to surfaces to remain and to facilitate the installation of new work. Where new masonry adjoins existing, the new work shall abut or tie into the existing construction as indicated. Provide square, straight edges and corners where existing

masonry adjoins new work and other locations.

### 3.1.6 Concrete

Saw concrete along straight lines to a depth of a minimum 2 inch. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete.

### 3.1.7 Miscellaneous Metal

Salvage shop-fabricated items such as access doors and frames, steel gratings, metal ladders, wire mesh partitions, metal railings, metal windows and similar items as whole units. Salvage light-gage and cold-formed metal framing, such as steel studs, steel trusses, metal gutters, roofing and siding, metal toilet partitions, toilet accessories and similar items. Scrap metal shall become the Contractor's property. Recycle scrap metal to the greatest extent possible as part of demolition operations.

### 3.1.8 Carpentry

Salvage and recycle lumber, millwork items, and finished boards except those that are unfit for reuse. Remove windows, doors and frames and similar items as whole units, complete with trim and accessories. Do not remove hardware attached to units, except for door closers. Brace the open end of door frames to prevent damage.

## 3.2 CONCURRENT EARTH-MOVING OPERATIONS

Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition work in areas occupied by structures to be demolished until all demolition in the area has been completed and debris removed. Fill holes, open basements and other hazardous openings.

## 3.3 DISPOSITION OF MATERIAL

### 3.3.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition and deconstruction, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition, deconstruction, and removal procedures, and authorization by the Contracting Officer to begin demolition and deconstruction. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

### 3.3.2 Reuse of Materials and Equipment

Remove and store materials and equipment listed and/or indicated to be reused or relocated to prevent damage, and reinstall as the work progresses.

### 3.3.3 Salvaged Materials and Equipment

Remove materials and equipment that are indicated and/or specified to be removed by the Contractor and that are to remain the property of the Government, and deliver to a storage site, on station as indicated or directed by the Contracting Officer.

- a. Salvage items and material to the maximum extent possible.
- b. Material salvaged for the Contractor shall be stored as approved by the Contracting Officer and shall be removed from Government property before completion of the contract. Material salvaged for the Contractor shall not be sold on the site.
- c. Salvaged items to remain the property of the Government shall be removed in a manner to prevent damage, and packed or crated to protect the items from damage while in storage or during shipment. Items damaged during removal or storage shall be repaired or replaced to match existing items. Containers shall be properly identified as to contents.
- d. Historical items shall be removed in a manner to prevent damage. The following historical items shall be delivered to the Government for disposition: Corner stones, contents of corner stones, and document boxes wherever located on the site.
- e. Remove and capture all Class I ODS refrigerants in accordance with the Clean Air Act Amendment of 1990, and remove from Government property and dispose of in accordance with 40 CFR 82.

### 3.3.4 Disposal of Ozone Depleting Substance (ODS)

Class I and Class II ODS are defined in Section, 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting ARI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling. Recovered ODS shall be removed from Government property and dispose of in accordance with 40 CFR 82. Products, equipment and appliances containing ODS in a sealed, self-contained system (e.g. residential refrigerators and window air conditioners) shall be disposed of in accordance with 40 CFR 82.

#### 3.3.4.1 Special Instructions

No more than one type of ODS is permitted in each container. A warning/hazardous label shall be applied to the containers in accordance with Department of Transportation regulations. All cylinders including but not limited to fire extinguishers, spheres, or canisters containing an ODS shall have a tag with the following information:

- a. Activity name and unit identification code
- b. Activity point of contact and phone number
- c. Type of ODS and pounds of ODS contained
- d. Date of shipment
- e. Naval stock number (for information, call (804) 279-4525).

#### 3.3.4.2 Fire Suppression Containers

Deactivate fire suppression system cylinders and canisters with electrical charges or initiators prior to shipment. Also, safety caps must be used to cover exposed actuation mechanisms and discharge ports on these special cylinders.

#### 3.3.5 Transportation Guidance

Shipment of all ODS containers shall be in accordance with MIL-STD-129, DLA 4145.25 (also referenced one of the following: Army Regulation 700-68, Naval Supply Instruction 4440.128C, Marine Corps Order 10330.2C, and Air Force Regulation 67-12), 49 CFR 173.301, and DOD 4000.25-1-M.

#### 3.3.6 Unsalvageable Material

Dispose of unsalvageable and non-recyclable noncombustible material from the project area, except concrete which shall be permitted to remain in place. Dispose of unsalvageable and non-recyclable combustible material off the site.

#### 3.4 CLEANUP

Debris and rubbish shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

#### 3.5 DISPOSAL OF REMOVED MATERIALS

##### 3.5.1 Disposal

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified off the center. Removed materials shall not be stored on the project site.

##### 3.5.2 Burning on Government Property

Burning of materials removed from demolished structures will not be permitted on Government property.

##### 3.5.3 Removal from Government Property

Transport waste materials removed from demolished structures, except waste soil, from Government property for legal disposal. Dispose of waste soil off of Government property, as indicated or as directed by the Contracting Officer.

#### 3.6 REUSE OF SALVAGED ITEMS

Recondition salvaged materials and equipment designated for reuse before installation. Replace items damaged during removal and salvage operations or restore them as necessary to usable condition.

-- End of Section --

SECTION 03 30 00

CAST-IN-PLACE CONCRETE FOR SITE WORK

01/08

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.

ACI INTERNATIONAL (ACI)

ACI/MCP-1	(2007) Manual of Concrete Practice Part 1: ACI 104-71R-97 to 223-98
ACI/MCP-2	(2007) Manual of Concrete Practice Part 2 - ACI 224R-01 to ACI 313R-97
ACI/MCP-3	(2007) Manual of Concrete Practice Part 3 - ACI 315-99 to ACI 343R-95
ACI/MCP-4	(2006) Manual of Concrete Practice Part 4 - ACI 345R-05 to 355.2R-04

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 182	(2005) Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats
AASHTO M 53	(1996) Standard Specification Axle-Steel Deformed and Plain Bars for Concrete Reinforcement

AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA A135.4	(2004) Basic Hardboard
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AMERICAN WELDING SOCIETY (AWS)

AWS D1.4/D1.4M	(2005; Errata 2005) Structural Welding Code - Reinforcing Steel
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ASTM INTERNATIONAL (ASTM)

ASTM A 185/A 185M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A 496/A 496M	(2007) Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
ASTM A 497/A 497M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Deformed, for

Concrete

ASTM A 615/A 615M	(2007) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A 706/A 706M	(2006a) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 780	(2001; R 2006) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A 82/A 82M	(2007) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A 996/A 996M	(2006a) Standard Specification for Rail-Steel and Axle-Steel Deformed Bars or Concrete Reinforcement
ASTM C 1017/C 1017M	(2007) Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 1107/C 1107M	(2007a) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 1260	(2007) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C 143/C 143M	(2005a) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C 150	(2007) Standard Specification for Portland Cement
ASTM C 156	(2005) Standard Test Method for Water Retention by Concrete Curing Materials
ASTM C 1567	(2007) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C 171	(2003) Standard Specification for Sheet Materials for Curing Concrete
ASTM C 172	(2007) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C 173/C 173M	(2007) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 192/C 192M	(2007) Standard Practice for Making and Curing Concrete Test Specimens in the

Laboratory

ASTM C 231	(2004) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 233	(2007) Standard Test Method for Air-Entraining Admixtures for Concrete
ASTM C 260	(2006) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C 295	(2003) Petrographic Examination of Aggregates for Concrete
ASTM C 309	(2007) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31/C 31M	(2006) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 311	(2005) Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete
ASTM C 33	(2003) Standard Specification for Concrete Aggregates
ASTM C 39/C 39M	(2005e1) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42/C 42M	(2004) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 494/C 494M	(2005a) Standard Specification for Chemical Admixtures for Concrete
ASTM C 595	(1997) Blended Hydraulic Cements (Metric)
ASTM C 618	(2005) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C 881/C 881M	(2002) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 932	(2006) Standard Specification for Surface-Applied Bonding Compounds for Exterior Plastering
ASTM C 94/C 94M	(2009) Standard Specification for Ready-Mixed Concrete
ASTM C 989	(2006) Standard Specification for Ground Granulated Blast-Furnace Slag for Use in

Concrete and Mortars

- ASTM D 1557 (2007) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>) (2,700 kN-m/m<sup>3</sup>))
- ASTM D 1751 (2004) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- ASTM D 1752 (2004a) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
- ASTM D 5759 (1995; R 2005) Characterization of Coal Fly Ash and Clean Coal Combustion Fly Ash for Potential Uses
- ASTM D 7116 (2005) Standard Specification for Joint Sealants, Hot Applied, Jet Fuel Resistant Types, for Portland Cement Concrete
- ASTM E 329 (2007) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
- ASTM E 648 (2006a) Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

- CRSI MSP-2 (1998) Manual of Standard Practice

FOREST STEWARDSHIP COUNCIL (FSC)

- FSC STD 01 001 (2000) Principles and Criteria for Forest Stewardship

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

- NIST PS 1 (1996) Construction and Industrial Plywood

U.S. DEPARTMENT OF COMMERCE (DOC)

- PS1 (1995) Consturction and Industrial Plywood (APA V995)

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

- FS LLL-B-810 (Rev B) Building Board, (Hardboard) Hard Pressed, Vegetable Fiber

- FS MMM-A-001993 (1978) Adhesive, Epoxy, Flexible, Filled (For Binding, Sealing, and Grouting)

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FS SS-S-200

(Rev E; Am 2) Sealant, Joint,  
Two-Component, Jet-Blast-Resistant,  
Cold-Applied, for Portland Cement Concrete  
Pavement

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED

(2002; R 2005) Leadership in Energy and  
Environmental Design(tm) Green Building  
Rating System for New Construction  
(LEED-NC)

1.2 DEFINITIONS

- a. "Cementitious material" as used herein must include all Portland cement, pozzolan, fly ash, and ground granulated blast-furnace slag.
- b. "Exposed to public view" means situated so that it can be seen from eye level from a public location after completion of the building. A public location is accessible to persons not responsible for operation or maintenance of the building.
- c. "Chemical admixtures" are materials in the form of powder or fluids that are added to the concrete to give it certain characteristics not obtainable with plain concrete mixes.
- d. "Workability (or consistence)" is the ability of a fresh (plastic) concrete mix to fill the form/mould properly with the desired work (vibration) and without reducing the concrete's quality. Workability depends on water content, chemical admixtures, aggregate (shape and size distribution), cementitious content and age (level of hydration).

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Formwork  
Reinforcing steel; G

Reproductions of contract drawings are unacceptable.

Provide erection drawings for concrete Formwork that show placement of reinforcement and accessories, with reference to the contract drawings.

SD-03 Product Data

Materials for curing concrete; G  
Joint sealants; (LEED) G

Submit manufacturer's product data, indicating VOC content. Manufacturer's catalog data for the following items must include

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printed instructions for admixtures, bonding agents, epoxy-resin adhesive binders, and waterstops.

Joint filler; (LEED); G  
Reinforcement; G  
Cement; (LEED); G  
Recycled Aggregate Materials; G

Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project.

Epoxy bonding compound; G  
Bonding materials; G  
Ready-Mix Concrete; G  
Curing Concrete Elements; G  
Local/Regional Materials; (LEED); G

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.

Biodegradable Form Release Agent; G

Submit documentation indicating type of biobased material in product and biobased content. Indicate relative dollar value of biobased content products to total dollar value of products included in project.

SD-05 Design Data

Concrete mix design; G

Thirty days minimum prior to concrete placement, submit a mix design for each strength and type of concrete. Submit a complete list of materials including type; brand; source and amount of cement, fly ash, pozzolans, ground slag and admixtures; and applicable reference specifications. Provide mix proportion data using at least three different water-cement ratios for each type of mixture, which produce a range of strength encompassing those required for each class and type of concrete required. If source material changes, resubmit mix proportion data using revised source material. Provide only materials that have been proven by trial mix studies to meet the requirements of this specification, unless otherwise approved in writing by the Contracting Officer. Indicate clearly in the submittal where each mix design is used when more than one mix design is submitted. Submit additional data regarding concrete aggregates if the source of aggregate changes. Submit copies of the fly ash and pozzolan test results, in addition. The approval of fly ash and pozzolan test results must be within 6 months of submittal date. Obtain acknowledgement of receipt prior to concrete placement.

SD-06 Test Reports

Concrete mix design; G

Fly ash  
Pozzolan  
Ground granulated blast-furnace slag  
Aggregates  
Compressive strength tests  
Slump  
Air Content  
Curing Concrete Elements

#### SD-07 Certificates

Pumping concrete  
Biodegradable Form Release Agent  
VOC Content for form release agents, curing compounds, and  
concrete penetrating sealers  
Material Safety Data Sheets  
Forest Stewardship Council (FSC) Certification

#### SD-08 Manufacturer's Instructions

Fly ash  
Ground granulated blast-furnace slag

Submit mill certificates for Steel Bar according to the paragraph  
entitled, "Fabrication," of this section.

Provide certificates for concrete that are in accordance with the  
paragraph entitled, "Classification and Quality of Concrete," of  
this section. Provide certificates that contain project name and  
number, date, name of Contractor, name of concrete testing  
service, source of concrete aggregates, material manufacturer,  
brand name of manufactured materials, material name, values as  
specified for each material, and test results. Provide  
certificates for Welder Qualifications that are in accordance with  
the paragraph entitled, "Qualifications for Welding Work," of this  
section.

### 1.4 MODIFICATION OF REFERENCES

Accomplish work in accordance with ACI publications except as modified  
herein. Consider the advisory or recommended provisions to be mandatory.  
Interpret reference to the "Building Official," the "Structural Engineer,"  
and the "Architect/Engineer" to mean the Contracting Officer.

### 1.5 DELIVERY, STORAGE, AND HANDLING

Do not deliver concrete until vapor barrier, forms, reinforcement, embedded  
items, and chamfer strips are in place and ready for concrete placement.  
ACI/MCP-2 for job site storage of materials. Protect materials from  
contaminants such as grease, oil, and dirt. Ensure materials can be  
accurately identified after bundles are broken and tags removed. Do not  
store concrete curing compounds or sealers with materials that have a high  
capacity to adsorb volatile organic compound (VOC) emissions. Do not store  
concrete curing compounds or sealers in occupied spaces.

#### 1.5.1 Reinforcement

Store reinforcement of different sizes and shapes in separate piles or  
racks raised above the ground to avoid excessive rusting. Protect from

contaminants such as grease, oil, and dirt. Ensure bar sizes can be accurately identified after bundles are broken and tags removed.

## 1.6 QUALITY ASSURANCE

### 1.6.1 Design Data

#### 1.6.1.1 Formwork Calculations

ACI/MCP-4. Include design calculations indicating arrangement of forms, sizes and grades of supports (lumber), panels, and related components. Furnish drawings and calculations of shoring and re-shoring methods proposed for floor and roof slabs, spandrel beams, and other horizontal concrete members.

### 1.6.2 Drawings

#### 1.6.2.1 Formwork

Drawings showing details of formwork including, but not limited to; joints, supports, studding and shoring, and sequence of form and shoring removal. Reproductions of contract drawings are unacceptable.

#### 1.6.2.2 Reinforcing Steel

ACI/MCP-4. Indicate bending diagrams, assembly diagrams, splicing and laps of bars, shapes, dimensions, and details of bar reinforcing, accessories, and concrete cover. Do not scale dimensions from structural drawings to determine lengths of reinforcing bars.

### 1.6.3 Control Submittals

#### 1.6.3.1 Curing Concrete Elements

Submit proposed materials and methods for curing concrete elements.

#### 1.6.3.2 Pumping Concrete

Submit proposed materials and methods for pumping concrete. Submittal must include mix designs, pumping equipment including type of pump and size and material for pipe, and maximum length and height concrete is to be pumped.

#### 1.6.3.3 Form Removal Schedule

Submit schedule for form removal indicating element and minimum length of time for form removal.

#### 1.6.3.4 VOC Content for form release agents, curing compounds, and concrete penetrating sealers

Submit certification for the form release agent, curing compounds, and concrete penetrating sealers that indicate the VOC content of each product.

#### 1.6.3.5 Material Safety Data Sheets

Submit Material Safety Data Sheets (MSDS) for all materials that are regulated for hazardous health effects. Prominently post the MSDS at the construction site.

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1.6.4 Test Reports

1.6.4.1 Concrete Mix Design

Submit copies of laboratory test reports showing that the mix has been successfully tested to produce concrete with the properties specified and that mix must be suitable for the job conditions. Include mill test and all other test for cement, aggregates, and admixtures in the laboratory test reports. Provide maximum nominal aggregate size, gradation analysis, percentage retained and passing sieve, and a graph of percentage retained verses sieve size. Submit test reports along with the concrete mix design. Obtain approval before concrete placement.

1.6.4.2 Fly Ash and Pozzolan

Submit test results in accordance with ASTM C 618 for fly ash and pozzolan. Submit test results performed within 6 months of submittal date. Submit manufacturer's policy statement on fly ash use in concrete.

1.6.4.3 Ground Granulated Blast-Furnace Slag

Submit test results in accordance with ASTM C 989 for ground granulated blast-furnace slag. Submit test results performed within 6 months of submittal date. Submit manufacturer's policy statement on slag use in concrete.

1.6.4.4 Aggregates

ASTM C 1260 for potential alkali-silica reactions, ASTM C 295 for petrographic analysis.

1.7 ENVIRONMENTAL REQUIREMENTS

Provide space ventilation according to manufacturer recommendations, at a minimum, during and following installation of concrete curing compound and sealer. Maintain one of the following ventilation conditions during the curing compound/sealer curing period or for 72 hours after installation:

- a. Supply 100 percent outside air 24 hours a day.
- b. Supply airflow at a rate of 6 air changes per hour, when outside temperatures are between 55 degrees F and 84 degrees F and humidity is between 30 percent and 60 percent.
- c. Supply airflow at a rate of 1.5 air changes per hour, when outside air conditions are not within the range stipulated above.

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.

1.8.2 Forest Stewardship Council (FSC) Certification

Use FSC-certified wood where specified. Provide letter of certification signed by lumber supplier. Indicate compliance with FSC STD 01 001 and

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identify certifying organization. Submit FSC certification numbers; identify each certified product on a line-item basis. Submit copies of invoices bearing the FSC certification numbers.

1.9 QUALIFICATIONS FOR CONCRETE TESTING SERVICE

Perform concrete testing by an approved laboratory and inspection service experienced in sampling and testing concrete. Testing agency must meet the requirements of ASTM E 329.

1.10 CONCRETE SAMPLING AND TESTING

Testing by the Contractor must include sampling and testing concrete materials proposed for use in the work and testing the design mix for each class of concrete. Perform quality control testing during construction.

Sample and test concrete aggregate materials proposed for use in the work in accordance with ASTM C 33.

Sample and test portland cement in accordance with ASTM C 150.

Sample and test air-entraining admixtures in accordance with ASTM C 233.

Testing must be performed by a Grade I Testing Technician.

PART 2 PRODUCTS

2.1 MATERIALS FOR FORMS

Provide wood, plywood, plastic, carton, or steel. Use plywood or steel forms where a smooth form finish is required.

2.1.1 Wood Forms

Provide lumber that is square edged or tongue-and-groove boards, free of raised grain, knotholes, or other surface defects. Provide plywood that complies with PS1, B-B concrete form panels or better or AHA A135.4, hardboard for smooth form lining. Submit data verifying that composite wood products contain no urea formaldehyde resins. Virgin wood used must be FSC-certified.

2.1.1.1 Concrete Form Plywood (Standard Rough)

Provide plywood that conforms to NIST PS 1, B-B, concrete form, not less than 5/8-inch thick.

2.1.1.2 Overlaid Concrete Form Plywood (Standard Smooth)

Provide plywood that conforms to NIST PS 1, B-B, high density form overlay, not less than 5/8-inch thick.

2.1.2 Plastic Forms

Provide plastic forms that contain a minimum of 50 percent post-consumer recycled content, or a minimum of 50 percent post-industrial recycled content.

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2.1.3 Carton Forms

Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete until initial set. Provide carton forms that contain a minimum of 5 percent post-consumer recycled content, or a minimum of 20 percent post-industrial recycled content.

2.1.4 Steel Forms

Provide steel form surfaces that do not contain irregularities, dents, or sags.

2.2 FORM TIES AND ACCESSORIES

The use of wire alone is prohibited. Provide form ties and accessories that do not reduce the effective cover of the reinforcement.

2.2.1 Dovetail Anchor Slot

Preformed metal slot approximately 1 by 1 inch of not less than 22 gage galvanized steel cast in concrete. Coordinate actual size and throat opening with dovetail anchors and provide with removable filler material.

2.3 CONCRETE

2.3.1 Contractor-Furnished Mix Design

ACI/MCP-1, ACI/MCP-2, and ACI/MCP-2, except as otherwise specified. The compressive strength (f'c) of the concrete for each portion of the structure(s) shall be as indicated and as specified below.

Location	f'c (Min. 28- Day Comp. Strength) (psi)	ASTM C 33 Maximum Nominal Aggregate (Size No.)	Range of Slump (inches)	Maximum Water- Cement Ratio (by weight)	Air Entr. (percent)
All areas	4,000	57	1-4	0.45-0.50	1-3

Maximum slump shown above may be increased 1 inch for methods of consolidation other than vibration. Slump may be increased to 8 inches when superplasticizers are used. Provide air entrainment using air-entraining admixture. Air entrainment shall be within plus or minus 1.5 percent of the value specified. The water soluble chloride ion concentrations in hardened concrete at ages from 28 to 42 days shall not exceed 0.15.

Note (a): Entrapped air shall be 3% or less.

Proportion concrete mixes for strength at 56 days.

2.3.1.1 Mix Proportions for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing requirements for various classes and types of concrete specified are the responsibility of the Contractor. Base mixture proportions on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 39/C 39M. Samples of all materials used in mixture proportioning studies must be representative

of those proposed for use in the project and must be accompanied by the manufacturer's or producer's test report indicating compliance with these specifications. Base trial mixtures having proportions, consistencies, and air content suitable for the work on methodology described in ACI/MCP-1. In the trial mixture, use at least three different water-cement ratios for each type of mixture, which must produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratio required must be based on equivalent water-cement ratio calculations as determined by the conversion from the weight ratio of water to cement plus pozzolan, and ground granulated blast-furnace slag by weight equivalency method. Design laboratory trial mixture for maximum permitted slump and air content. Each combination of material proposed for use must have separate trial mixture, except for accelerator or retarder use can be provided without separate trial mixture. Report the temperature of concrete in each trial batch. For each general purpose mix design (as indicated) and water-cement ratio, at least three test cylinders for each test age must be made and cured in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 39/C 39M for 7 and 28 day compressive strength. From these results, plot curves showing the relationship between water-cement ratio and strength (compressive) for each set of trial mix studies. In addition, plot curves showing the relationship between 7 and 28 day compressive strengths.

#### 2.3.1.2 Required Average Strength of Mix Design

The selected mixture must produce an average compressive strength exceeding the specified strength by the amount indicated in ACI/MCP-2. When a concrete production facility has a record of at least 15 consecutive tests, the standard deviation must be calculated and the required average compressive strength or flexural strength must be determined in accordance with ACI/MCP-2. When a concrete production facility does not have a suitable record of tests to establish a standard deviation, the required average strength must follow ACI/MCP-2 requirements.

#### 2.3.2 Ready-Mix Concrete

Provide concrete that meets the requirements of ASTM C 94/C 94M.

Ready-mixed concrete manufacturer must provide duplicate delivery tickets with each load of concrete delivered. Provide delivery tickets with the following information in addition to that required by ASTM C 94/C 94M:

Type and brand cement

Cement content in 95-pound bags per cubic yard of concrete

Maximum size of aggregate

Amount and brand name of admixtures

Total water content expressed by water/cement ratio

#### 2.3.3 Concrete Curing Materials

##### 2.3.3.1 Absorptive Cover

Provide burlap cloth cover for curing concrete made from jute or kenaf, weighing 10 ounces plus or minus 5 percent per square yard when clean and dry, conforming to ASTM C 171, Class 3; or cover may be cotton mats as

approved.

#### 2.3.3.2 Moisture-Retaining Cover

Provide waterproof paper cover for curing concrete conforming to ASTM C 171, regular or white, or polyethylene sheeting conforming to ASTM C 171, or polyethylene-coated burlap consisting of a laminate of burlap and a white opaque polyethylene film permanently bonded to the burlap; burlap must conform to ASTM C 171, Class 3, and polyethylene film must conform to ASTM C 171. When tested for water retention in accordance with ASTM C 156, weight of water lost 72 hours after application of moisture retaining covering material must not exceed 0.039 gram per square centimeter of the mortar specimen surface.

#### 2.3.3.3 Membrane-Forming Curing Compound

Provide liquid type compound conforming to ASTM C 309, Type 1, clear, Type 1D with fugitive dye for interior work and Type 2, white, pigmented for exterior work.

### 2.4 MATERIALS

#### 2.4.1 Cement

ASTM C 150, Type I or II or ASTM C 595, Type IP(MS) or IS(MS) blended cement except as modified herein. Provide blended cement that consists of a mixture of ASTM C 150, Type II, cement and one of the following materials: ASTM C 618 pozzolan or fly ash, ASTM C 989 ground granulated blast-furnace slag. For Portland cement manufactured in a kiln fueled by hazardous waste, maintain a record of source for each batch. Supplier must certify that the hazardous waste is neutralized by the manufacturing process and that no additional pollutants are discharged. For exposed concrete, use one manufacturer for each type of cement, ground slag, fly ash, and pozzolan.

##### 2.4.1.1 Fly Ash and Pozzolan

ASTM C 618, Type N, F, or C, except that the maximum allowable loss on ignition must be 6 percent for Types N and F. Add with cement. Fly ash content must be a minimum of 15 percent by weight of cementitious material, provided the fly ash does not reduce the amount of cement in the concrete mix below the minimum requirements of local building codes. Where the use of fly ash cannot meet the minimum level, provide the maximum amount of fly ash permissible that meets the code requirements for cement content. Report the chemical analysis of the fly ash in accordance with ASTM C 311. Evaluate and classify fly ash in accordance with ASTM D 5759.

High contents of supplementary cementitious materials can have some detrimental effects on the concrete properties, such as slowing excessively the strength gain rate, and delaying and increasing the difficulty of finishing. The recommended maximum content (by weight of the total cementitious material) for these materials are:

1. For GGBF slag: 50 percent.
2. For fly ash or natural pozzolan: 40 percent (25 percent in cold climates).

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2.4.1.2 Ground Granulated Blast-Furnace Slag

ASTM C 989, Grade 80. Slag content must be a minimum of 25 percent by weight of cementitious material.

2.4.1.3 Portland Cement

Provide cement that conforms to ASTM C 150, Type I, IA, II, or IIA. Use one brand and type of cement for formed concrete having exposed-to-view finished surfaces.

2.4.2 Water

Minimize the amount of water in the mix. The amount of water must not exceed 45 percent by weight of cementitious materials (cement + pozzolans), and in general, improve workability by adjusting the grading rather than by adding water. Water must be fresh, clean, and potable; free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances deleterious to concrete.

2.4.3 Aggregates

ASTM C 33, except as modified herein. Furnish aggregates for exposed concrete surfaces from one source. Provide aggregates that do not contain any substance which may be deleteriously reactive with the alkalis in the cement.

Fine and coarse aggregates must show expansions less than 0.08 percent at 16 days after casting when testing in accordance with ASTM C 1260. Should the test data indicate an expansion of 0.08 percent or greater, reject the aggregate(s) or perform additional testing using ASTM C 1567 using the Contractor's proposed mix design. In this case, include the mix design low alkali portland cement and one of the following supplementary cementitious materials:

1. GGBF slag at a minimum of 40 percent of total cementitious
2. Fly ash or natural pozzolan at a minimum of total cementitious of
  - a. 30 percent if  $(\text{SiO}_2 + \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3)$  is 65 percent or more,
  - b. 25 percent if  $(\text{SiO}_2 + \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3)$  is 70 percent or more,
  - c. 20 percent if  $(\text{SiO}_2 + \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3)$  is 80 percent or more,
  - d. 15 percent if  $(\text{SiO}_2 + \text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3)$  is 90 percent or more.

If a combination of these materials is chosen, the minimum amount must be a linear combination of the minimum amounts above. Include these materials in sufficient proportion to show less than 0.08 percent expansion at 16 days after casting when tested in accordance with ASTM C 1567.

Aggregates must not possess properties or constituents that are known to have specific unfavorable effects in concrete when tested in accordance with ASTM C 295.

2.4.3.1 Recycled Aggregate Materials

Use a minimum of 25 percent recycled aggregate, depending on local availability and conforming to requirements of the mix design. Recycled aggregate to include: recovered glass, recovered concrete, recovered porcelain, recovered stone, that meets the aggregate requirements specified. Submit recycled material request with the aggregate

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certification submittals and do not use until approved by the Contracting Officer.

2.4.4 Nonshrink Grout

ASTM C 1107/C 1107M.

2.4.5 Admixtures

ASTM C 494/C 494M: Type A, water reducing; Type B, retarding; Type C, accelerating; Type D, water-reducing and retarding; and Type E, water-reducing and accelerating admixture. Do not use calcium chloride admixtures.

2.4.5.1 Air-Entraining

ASTM C 260.

2.4.5.2 High Range Water Reducer (HRWR) (Superplasticizers)

ASTM C 494/C 494M, Type F and Type G (HRWR retarding admixture) and ASTM C 1017/C 1017M.

2.4.5.3 Pozzolan

Provide fly ash or other pozzolans used as admixtures that conform to ASTM C 618.

2.4.6 Materials for Curing Concrete

Use water-based curing compounds, sealers, and coatings with low (maximum 160 grams/liter, less water and less exempt compounds) VOC content.

Consider the use of water based or vegetable or soy based curing agents in lieu of petroleum based products. Consider agents that are not toxic and emit low or no Volatile Organic Compounds (VOC). Consider the use of admixtures that offer high performance to increase durability of the finish product but also have low toxicity and are made from bio-based materials such as soy, and emit low levels of Volatile Organic Compounds (VOC).

2.4.6.1 Impervious Sheeting

ASTM C 171; waterproof paper, clear or white polyethylene sheeting, or polyethylene-coated burlap.

2.4.6.2 Pervious Sheeting

AASHTO M 182.

2.4.6.3 Liquid Membrane-Forming Compound

ASTM C 309, white-pigmented, Type 2, Class B.

2.4.7 Expansion/Contraction Joint Filler

ASTM D 1751, ASTM D 1752, cork or 100% post-consumer paper meeting ASTM D 1752 (subparagraphs 5.1 to 5.4). Material must be 1/2 inch thick, unless otherwise indicated.

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2.4.7.1 Preformed Joint Filler Strips

Provide nonextruding and resilient bituminous type filler strips conforming to ASTM D 1751.

Provide nonextruding and resilient nonbituminous type filler strips conforming to ASTM D 1752, Type I or II.

2.4.8 Joint Sealants

Use concrete penetrating sealers with a low (maximum 100 grams/liter, less water and less exempt compounds) VOC content.

2.4.8.1 Horizontal Surfaces, 3 Percent Slope, Maximum

ASTM D 7116 for surfaces subjected to jet fuel.

2.4.8.2 Vertical Surfaces Greater Than 3 Percent Slope

FS SS-S-200, no sag.

2.4.8.3 Joint Sealant Compound

Provide cold-applied, two-component, elastomeric polymer type compound conforming to FS SS-S-200.

2.4.9 Epoxy Bonding Compound

ASTM C 881/C 881M. Provide Type I for bonding hardened concrete to hardened concrete; Type II for bonding freshly mixed concrete to hardened concrete; and Type III as a binder in epoxy mortar or concrete, or for use in bonding skid-resistant materials to hardened concrete. Provide Grade 1 or 2 for horizontal surfaces and Grade 3 for vertical surfaces. Provide Class A if placement temperature is below 40 degrees F; Class B if placement temperature is between 40 and 60 degrees F; or Class C if placement temperature is above 60 degrees F.

2.4.10 Biodegradable Form Release Agent

Provide form release agent that is colorless, biodegradable, and rapeseed oil-based, soy oil-based, or water-based, with a low (maximum of 55 grams/liter (g/l)) VOC content. A minimum of 85 percent of the total product must be biobased material. Provide product that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces. Provide form release agent that does not contain diesel fuel, petroleum-based lubricating oils, waxes, or kerosene.

2.5 REINFORCEMENT

Galvanize connectors and chairs.

2.5.1 Reinforcing Bars

ACI/MCP-2 unless otherwise specified. Use deformed steel. ASTM A 615/A 615M and AASHTO M 53 with the bars marked A, S, W, Grade 60; or ASTM A 996/A 996M with the bars marked R, Grade 60, or marked A, Grade 60. Provide reinforcing bars that contain a minimum of 100 percent recycled content. Reinforcing bars may contain post-consumer or post-industrial recycled content.

#### 2.5.1.1 Weldable Reinforcing Bars

Provide weldable reinforcing bars that conform to ASTM A 706/A 706M and ASTM A 615/A 615M and Supplement S1, Grade 60, except that the maximum carbon content must be 0.55 percent.

#### 2.5.2 Mechanical Reinforcing Bar Connectors

ACI/MCP-2. Provide 125 percent minimum yield strength of the reinforcement bar.

#### 2.5.3 Wire

ASTM A 82/A 82M or ASTM A 496/A 496M.

##### 2.5.3.1 Welded Wire Fabric

ASTM A 185/A 185M or ASTM A 497/A 497M. Provide fabric that contains a minimum of 50 percent recycled content. Wire fabric may contain post-consumer or post-industrial recycled content. Provide flat sheets of welded wire fabric for slabs and toppings.

##### 2.5.3.2 Steel Wire

Wire must conform to ASTM A 82/A 82M.

#### 2.5.4 Reinforcing Bar Supports

Provide bar ties and supports of coated or non-corrodible material.

#### 2.5.5 Supports for Reinforcement

Supports include bolsters, chairs, spacers, and other devices necessary for proper spacing, supporting, and fastening reinforcing bars and wire fabric in place.

Provide wire bar type supports conforming to ACI/MCP-3 and CRSI MSP-2.

Legs of supports in contact with formwork must be hot-dip galvanized, or plastic coated after fabrication, or stainless-steel bar supports.

### 2.6 BONDING MATERIALS

#### 2.6.1 Concrete Bonding Agent

Provide aqueous-phase, film-forming, nonoxidizing, freeze and thaw-resistant compound agent suitable for brush or spray application conforming to ASTM C 932.

#### 2.6.2 Epoxy-Resin Adhesive Binder

Provide two-component, epoxy-polysulfide polymer type binder with an amine-type curing-agent conforming to FS MMM-A-001993, Type I or ASTM C 881/C 881M.

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2.7 CLASSIFICATION AND QUALITY OF CONCRETE

2.7.1 Concrete Classes and Usage

Provide concrete classes, compressive strength, requirements for air entrainment, and usage as follows:

<u>CONCRETE CLASS</u>	<u>MIN. 28-DAY COMPRESSIVE STRENGTH POUNDS PER SQ. IN.</u>	<u>REQUIREMENT FOR AIR ENTRAINMENT</u>	<u>USAGE</u>
3A	3,000	Air-entrained	For foundation concrete work exposed to freezing and thawing or subjected to hydraulic pressure, such as foundation walls, grade beams, pits, tunnels. For exterior concrete slabs, such as steps, platforms, walks
4A	4,000	Air-entrained	For structural concrete work as indicated

2.7.2 Limits for Concrete Proportions

Provide limits for maximum water/cement ratio and minimum cement content for each concrete class as follows:

<u>CONCRETE CLASS</u>	<u>MAX. WATER/CEMENT RATIO BY WEIGHT</u>	<u>MIN. CEMENT FOR 3- TO 4-INCH SLUMP, (NO. OF 94- POUND SACKS) PER CU. YD.</u>
3A	0.50	5.25
4A	0.41	6.5

\* Weight of water to weight of cement in pounds in one cubic yard of concrete

2.7.3 Maximum Size of Aggregate

Size of aggregate, designated by the sieve size on which maximum amount of retained coarse aggregate is 5 to 10 percent by weight, must be as follows:

<u>MAXIMUM SIZE OF AGGREGATE</u>	<u>ASTM C 33 SIZE NUMBER</u>	<u>TYPE OF CONSTRUCTION</u>
2 inches	357	Nonreinforced footings and other flat work having a depth of not less than 6 inches, and

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<u>MAXIMUM SIZE OF AGGREGATE</u>	<u>ASTM C 33 SIZE NUMBER</u>	<u>TYPE OF CONSTRUCTION</u>
		nonreinforced walls and other formed sections having a dimension between forms of not less than 10 inches
1-1/2 inches	467	Monolithic slabs on ground, concrete fill, and other flatwork having a depth of not less than 5 inches and a clear distance between reinforcing bars of not less than 2 inches
1 inch	57	Monolithic concrete slabs and other flatwork having a depth of not less than 2-1/2 inches and a clear distance between reinforcing bars of not less than 1.5 inches
3/4 inch	67	Reinforced walls, columns, girders, beams, and other formed sections having a dimension between forms of not less than 6 inches and clear distance between reinforcing bars or reinforcing bar and face of form of not less than 1 inch
3/4 inch	67	Monolithic concrete slabs and other flatwork having a depth of not less than 2-1/2 inches and a clear distance between reinforcing bars of not less than 1 inch
1/2 inch	7	Concrete joist construction, beams, reinforced walls, and other formed work having a clear distance between reinforcing bars and face of form of less than 1 inch
3/8 inch	8	Nonreinforced slabs and other flatwork having a depth of less than 2-1/2 inches

Maximum size of aggregate may be that required for most critical type of construction using that concrete class.

Specify gradation of aggregates for separate floor topping.

#### 2.7.4 Slump

Provide slump for concrete at time and in location of placement as follows:

<u>TYPE OF CONSTRUCTION</u>	<u>SLUMP</u>
Footings, unreinforced walls	Not less than 1 inch nor more than 3 inches
Columns, beams, reinforced walls, monolithic slabs	Not less than 1 inch nor more than 4 inches
Ramps and other sloping surfaces	0 nor more than 3 inches

### 2.7.5 Total Air Content

Air content of exposed concrete and interior concrete must be in accordance with ASTM C 260 and/or as follows:

<u>LIMITS</u>	<u>REQUIREMENT</u>	<u>MAXIMUM SIZE</u>	<u>TOTAL AIR CONTENT</u>
<u>CONCRETE</u>	<u>FOR AIR</u>	<u>OF AGGREGATE</u>	<u>BY VOLUME</u>
<u>EXPOSURE</u>	<u>ENTRAINMENT</u>		
Exposed to freezing and thawing or subjected to hydraulic pressure	Air-entrained	1-1/2 or 2 inches	4 to 6 percent
		1 - 3/4 inch	5 to 7 percent
		1/2 or 3/8 inch	6 to 8.5 percent

Provide concrete exposed to freezing and thawing or subjected to hydraulic pressure that is air-entrained by addition of approved air-entraining admixture to concrete mix.

## PART 3 EXECUTION

### 3.1 EXAMINATION

Do not begin installation until substrates have been properly constructed; verify that substrates are plumb and true.

If substrate preparation is the responsibility of another installer, notify the Contracting Officer of unsatisfactory preparation before processing.

Check field dimensions before beginning installation. If dimensions vary too much from design dimensions for proper installation, notify the Contracting Officer and wait for instructions before beginning installation.

### 3.2 PREPARATION

Determine quantity of concrete needed and minimize the production of excess concrete. Designate locations or uses for potential excess concrete before the concrete is poured.

#### 3.2.1 General

Surfaces against which concrete is to be placed must be free of debris, loose material, standing water, snow, ice, and other deleterious substances before start of concrete placing.

Remove standing water without washing over freshly deposited concrete.

Divert flow of water through side drains provided for such purpose.

### 3.2.2 Subgrade Under Foundations and Footings

When subgrade material is semiporous and dry, sprinkle subgrade surface with water as required to eliminate suction at the time concrete is deposited. When subgrade material is porous, seal subgrade surface by covering surface with specified water barrier subgrade cover; this may also be used over semiporous, dry subgrade material instead of water sprinkling.

### 3.2.3 Subgrade Under Slabs on Ground

Before construction of slabs on ground, have underground work on pipes and conduits completed and approved.

Previously constructed subgrade or fill must be cleaned of foreign materials and inspected by the Contractor for adequate compaction and surface tolerances as specified.

Actual density of top 12 inches of subgrade soil material-in-place must not be less than the following percentages of maximum density of same soil material compacted at optimum moisture content in accordance with ASTM D 1557.

<u>SOIL MATERIAL</u>	<u>PERCENT MAXIMUM DENSITY</u>
Drainage fill	100
Cohesionless soil material	100
Cohesive soil material	95

Finish surface of drainage fill under interior slabs on ground must not show deviation in excess of 1/4 inch when tested with a 10-foot straightedge parallel with and at right angles to building lines.

Finished surface of subgrade or fill under exterior slabs on ground must not be more than 0.02-foot above or 0.10-foot below elevation indicated.

Cover drainage fill surface under interior slabs on ground with specified water-vapor barrier subgrade cover immediately prior to placing reinforcement. Install subgrade cover to avoid puncture or tear. Patch punctures or tears over 12 inches with separate sheets lapped not less than 6 inches. Seal all punctures or tears less than 12 inches with pressure-sensitive vapor barrier tape not less than 2-inches wide. Seal lapped joints with vapor barrier adhesive or pressure-sensitive vapor barrier tape not less than 2-inches wide. Lay subgrade cover sheets with not less than a 6-inch lap at edges and ends and in direction in which concrete is to be placed.

Prepare subgrade or fill surface under exterior slabs on ground as specified for subgrade under foundations and footings.

### 3.2.4 Formwork

Complete and approve formwork. Remove debris and foreign material from interior of forms before start of concrete placing.

### 3.2.5 Edge Forms and Screed Strips for Slabs

Set edge forms or bulkheads and intermediate screed strips for slabs to obtain indicated elevations and contours in finished slab surface and must be strong enough to support vibrating bridge screeds or roller pipe screeds if nature of specified slab finish requires use of such equipment. Align concrete surface to elevation of screed strips by use of strike-off templates or approved compacting-type screeds.

### 3.2.6 Reinforcement and Other Embedded Items

Secure reinforcement, joint materials, and other embedded materials in position, inspected, and approved before start of concrete placing.

## 3.3 FORMS

ACI/MCP-2. Provide forms, shoring, and scaffolding for concrete placement. Set forms mortar-tight and true to line and grade. Chamfer above grade exposed joints, edges, and external corners of concrete 0.75 inch unless otherwise indicated. Provide formwork with clean-out openings to permit inspection and removal of debris. Forms submerged in water must be watertight.

### 3.3.1 General

Construct forms to conform, within the tolerances specified, to shapes dimensions, lines, elevations, and positions of cast-in-place concrete members as indicated. Forms must be supported, braced, and maintained sufficiently rigid to prevent deformation under load.

### 3.3.2 Design and Construction of Formwork

Provide formwork design and construction that conforms to and ACI/MCP-2, Chapter 4.

Provide forms that are tight to prevent leakage of cement paste during concrete placing.

Support form facing materials by structural members spaced close to prevent deflection of form facing material. Fit forms placed in successive units for continuous surfaces to accurate alignment to ensure a smooth completed surface within the tolerances specified. Where necessary to maintain the tolerances specified, such as long spans where immediate supports are not possible, camber formwork for anticipated deflections in formwork due to weight and pressure of fresh concrete and to construction loads.

Chamfer exposed joints, edges, and external corners a minimum of 3/4 inch by moldings placed in corners of column, beam, and wall forms.

Provide shores and struts with a positive means of adjustment capable of taking up formwork settlement during concrete placing operations. Obtain adjustment with wedges or jacks or a combination thereof. When adequate foundations for shores and struts cannot be secured, provide trussed supports.

Provide temporary openings in wall forms, column forms, and at other points where necessary to permit inspection and to facilitate cleaning.

Provide forms that are readily removable without impact, shock, or damage

to concrete.

### 3.3.3 Coating

Before concrete placement, coat the contact surfaces of forms with a nonstaining mineral oil, nonstaining form coating compound, or two coats of nitrocellulose lacquer. Do not use mineral oil on forms for surfaces to which adhesive, paint, or other finish material is to be applied.

### 3.3.4 Reshoring

Reshore concrete elements where forms are removed prior to the specified time period. Do not permit elements to deflect or accept loads during form stripping or reshoring. Forms on columns, walls, or other load-bearing members may be stripped after 2 days if loads are not applied to the members. After forms are removed, reshore slabs and beams over 10 feet in span and cantilevers over 4 feet for the remainder of the specified time period in accordance with paragraph entitled "Removal of Forms." Perform reshoring operations to prevent subjecting concrete members to overloads, eccentric loading, or reverse bending. Provide reshoring elements with the same load-carrying capabilities as original shoring and spaced similar to original shoring. Firmly secure and brace reshoring elements to provide solid bearing and support.

### 3.3.5 Reuse

Reuse forms providing the structural integrity of concrete and the aesthetics of exposed concrete are not compromised.

### 3.3.6 Forms for Standard Rough Form Finish

Give rough form finish concrete formed surfaces that are to be concealed by other construction, unless otherwise specified.

Form facing material for standard rough form finish must be the specified concrete form plywood or other approved form facing material that produces concrete surfaces equivalent in smoothness and appearance to that produced by new concrete form plywood panels.

For concrete surfaces exposed only to the ground, undressed, square-edge, 1-inch nominal thickness lumber may be used. Provide horizontal joints that are level and vertical joints that are plumb.

### 3.3.7 Forms for Standard Smooth Form Finish

Give smooth form finish concrete formed surfaces that are to be exposed to view or that are to be covered with coating material applied directly to concrete or with covering material bonded to concrete, such as waterproofing, dampproofing, painting, or other similar coating system.

Form facing material for standard smooth finish must be the specified overlaid concrete form plywood or other approved form facing material that is nonreactive with concrete and that produce concrete surfaces equivalent in smoothness and appearance to that produced by new overlaid concrete form plywood panels.

Maximum deflection of form facing material between supports and maximum deflection of form supports such as studs and wales must not exceed 0.0025 times the span.

Provide arrangement of form facing sheets that are orderly and symmetrical, and sheets that are in sizes as large as practical.

Arrange panels to make a symmetrical pattern of joints. Horizontal and vertical joints must be solidly backed and butted tight to prevent leakage and fins.

### 3.3.8 Form Ties

Provide ties that are factory fabricated metal, adjustable in length, removable or snap-off type that do allow form deflection or do not spall concrete upon removal. Portion of form ties remaining within concrete after removal of exterior parts must be at least 1-1/2 inches back from concrete surface. Provide form ties that are free of devices that leave a hole larger than 7/8 inch or less than 1/2 inch in diameter in concrete surface. Form ties fabricated at the project site or wire ties of any type are not acceptable.

### 3.3.9 Forms for Concrete Pan Joist Construction

Provide forms that are well-fitting, undamaged, factory-fabricated pan form units for concrete joist construction as indicated.

Form units complete with covers and end closures as required for the installation must be one of the following materials:

Steel, 16-gage, free from irregularities, dents, sag, and rust

Hardboard conforming to FS LLL-B-810, 1/4-inch thick, coated with waterproof plastic

Glass-fiber-reinforced plastic, molded under pressure, with matched dies, 0.11-inch maximum wall thickness

Asphalt-impregnated, corrugated material treated for moisture resistance with factory-applied polyethylene coating, with top and side cover joints taped where concrete is exposed.

Provide tight forms for concrete pan joist construction to prevent cement paste loss during concrete placing and to form a true, clean, smooth surface, free of honeycomb and rough exposed-aggregate areas. Take precautions, including blocking of adjoining pan units, to avoid lateral deflection of formwork during compaction of concrete.

### 3.3.10 Tolerances for Form Construction

Construct formwork to ensure that after removal of forms and prior to patching and finishing of formed surfaces, provide concrete surfaces in accordance with tolerances specified in ACI/MCP-1 and ACI/MCP-2.

### 3.3.11 Removal of Forms and Supports

After placing concrete, forms must remain in place for the time periods specified in ACI/MCP-4. Do not remove forms and shores (except those used for slabs on grade and slip forms) until the client determines that the concrete has gained sufficient strength to support its weight and superimposed loads. Base such determination on compliance with one of the following:

- a. The plans and specifications stipulate conditions for removal of forms and shores, and such conditions have been followed, or
- b. The concrete has been properly tested with an appropriate ASTM standard test method designed to indicate the concrete compressive strength, and the test results indicate that the concrete has gained sufficient strength to support its weight and superimposed loads.

Prevent concrete damage during form removal. Clean all forms immediately after removal.

#### 3.3.11.1 Special Requirements for Reduced Time Period

Forms may be removed earlier than specified if ASTM C 39/C 39M test results of field-cured samples from a representative portion of the structure indicate that the concrete has reached a minimum of 85 percent of the design strength.

#### 3.4 WATERSTOP SPLICES

Fusion weld in the field.

#### 3.5 FORMED SURFACES

##### 3.5.1 Preparation of Form Surfaces

Coat contact surfaces of forms with form-coating compound before reinforcement is placed. Provide a commercial formulation form-coating compound that does not bond with, stain, nor adversely affect concrete surfaces and impair subsequent treatment of concrete surfaces that entails bonding or adhesion nor impede wetting of surfaces to be cured with water or curing compounds. Do not allow excess form-coating compound to stand in puddles in the forms nor to come in contact with concrete against which fresh concrete is placed. Make thinning of form-coating compound with thinning agent of the type, in the amount, and under the conditions recommended by form-coating compound manufacturer's printed or written directions.

##### 3.5.2 Tolerances

ACI/MCP-4 and as indicated.

##### 3.5.3 As-Cast Form

Provide form facing material producing a smooth, hard, uniform texture on the concrete. Arrange facing material in an orderly and symmetrical manner and keep seams to a practical minimum. Support forms as necessary to meet required tolerances. Do not use material with raised grain, torn surfaces, worn edges, patches, dents, or other defects which can impair the texture of the concrete surface.

#### 3.6 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

ACI/MCP-2. Provide bars, wire fabric, wire ties, supports, and other devices necessary to install and secure reinforcement. Reinforcement must not have rust, scale, oil, grease, clay, or foreign substances that would reduce the bond. Rusting of reinforcement is a basis of rejection if the effective cross-sectional area or the nominal weight per unit length has

been reduced. Remove loose rust prior to placing steel. Tack welding is prohibited.

#### 3.6.1 General

Provide details of reinforcement that are in accordance with, and ACI/MCP-4 and as specified.

#### 3.6.2 Vapor Barrier

Provide beneath the on-grade concrete floor slab. Use the greatest widths and lengths practicable to eliminate joints wherever possible. Lap joints a minimum of 12 inches and tape or cement joints. Remove torn, punctured, or damaged vapor barrier material and provide with new vapor barrier prior to placing concrete. Concrete placement must not damage vapor barrier material. Place a 2 inch layer of clean concrete sand on vapor barrier before placing concrete.

#### 3.6.3 Reinforcement Supports

Place reinforcement and secure with galvanized or non corrodible chairs, spacers, or metal hangers. For supporting reinforcement on the ground, use concrete or other non corrodible material, having a compressive strength equal to or greater than the concrete being placed.

#### 3.6.4 Splicing

As indicated. For splices not indicated ACI/MCP-2. Do not splice at points of maximum stress. Overlap welded wire fabric the spacing of the cross wires, plus 2 inches. AWS D1.4/D1.4M. Approve welded splices prior to use. Repair the cut ends of hot-dipped galvanized reinforcement steel to completely coat exposed steel, ASTM A 780.

#### 3.6.5 Future Bonding

Plug exposed, threaded, mechanical reinforcement bar connectors with a greased bolt. Provide bolt threads that match the connector. Countersink the connector in the concrete. Caulk the depression after the bolt is installed.

#### 3.6.6 Cover

ACI/MCP-2 for minimum coverage, unless otherwise indicated.

#### 3.6.7 Setting Miscellaneous Material

Place and secure anchors and bolts, pipe sleeves, conduits, and other such items in position before concrete placement. Plumb anchor bolts and check location and elevation. Temporarily fill voids in sleeves with readily removable material to prevent the entry of concrete.

#### 3.6.8 Construction Joints

Locate joints to least impair strength. Continue reinforcement across joints unless otherwise indicated.

#### 3.6.9 Expansion Joints and Contraction Joints

Provide expansion joint at edges of interior floor slabs on grade abutting

vertical surfaces, and as indicated. Make expansion joints 1/2 inch wide unless indicated otherwise. Fill expansion joints not exposed to weather with preformed joint filler material. Completely fill joints exposed to weather with joint filler material and joint sealant. Do not extend reinforcement or other embedded metal items bonded to the concrete through any expansion joint unless an expansion sleeve is used. Provide contraction joints, either formed or saw cut or cut with a jointing tool, to the indicated depth after the surface has been finished. Complete saw joints within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.

#### 3.6.10 Fabrication

Shop fabricate reinforcing bars to conform to shapes and dimensions indicated for reinforcement, and as follows:

Provide fabrication tolerances that are in accordance with ACI/MCP-1, ACI/MCP-2 and ACI/MCP-3.

Provide hooks and bends that are in accordance with and ACI/MCP-3.

Reinforcement must be bent cold to shapes as indicated. Bending must be done in the shop. Rebending of a reinforcing bar that has been bent incorrectly is not be permitted. Bending must be in accordance with standard approved practice and by approved machine methods.

Tolerance on nominally square-cut, reinforcing bar ends must be in accordance with ACI/MCP-3.

Deliver reinforcing bars bundled, tagged, and marked. Tags must be metal with bar size, length, mark, and other information pressed in by machine. Marks must correspond with those used on the placing drawings.

Do not use reinforcement that has any of the following defects:

- a. Bar lengths, depths, and bends beyond specified fabrication tolerances
- b. Bends or kinks not indicated on drawings or approved shop drawings
- c. Bars with reduced cross-section due to rusting or other cause

Replace defective reinforcement with new reinforcement having required shape, form, and cross-section area.

#### 3.6.11 Placing Reinforcement

Place reinforcement in accordance with ACI/MCP-4.

For slabs on grade (over earth or over capillary water barrier) and for footing reinforcement, support bars or welded wire fabric on precast concrete blocks, spaced at intervals required by size of reinforcement, to keep reinforcement the minimum height specified above the underside of slab or footing.

For slabs other than on grade, supports for which any portion is less than 1 inch from concrete surfaces that are exposed to view or to be painted must be of precast concrete units, plastic-coated steel, or stainless steel protected bar supports. Precast concrete units must be wedge shaped, not

larger than 3-1/2 by 3-1/2 inches, and of thickness equal to that indicated for concrete protection of reinforcement. Provide precast units that have cast-in galvanized tie wire hooked for anchorage and blend with concrete surfaces after finishing is completed.

Contractor must cooperate with other trades in setting of anchor bolts, inserts, and other embedded items. Where conflicts occur between locating reinforcing and embedded items, the Contractor must notify the Contracting Officer so that conflicts may be reconciled before placing concrete. Anchors and embedded items must be positioned and supported with appropriate accessories.

Provide reinforcement that is supported and secured together to prevent displacement by construction loads or by placing of wet concrete, and as follows:

Provide supports for reinforcing bars that are sufficient in number and sufficiently heavy to carry the reinforcement they support, and in accordance with ACI/MCP-4 and CRSI MSP-2. Do not use supports to support runways for concrete conveying equipment and similar construction loads.

Equip supports on ground and similar surfaces with sand-plates.

Support welded wire fabric as required for reinforcing bars.

Secure reinforcements to supports by means of tie wire. Wire must be black, soft iron wire, not less than 16 gage.

With the exception of temperature reinforcement, tied to main steel approximately 24 inches on center, reinforcement must be accurately placed, securely tied at intersections with 18-gage annealed wire, and held in position during placing of concrete by spacers, chairs, or other approved supports. Point wire-tie ends away from the form. Unless otherwise indicated, numbers, type, and spacing of supports must conform to ACI/MCP-3.

Bending of reinforcing bars partially embedded in concrete is permitted only as specified in ACI/MCP-4.

#### 3.6.12 Spacing of Reinforcing Bars

Spacing must be as indicated. If not indicated, spacing must be in accordance with the ACI/MCP-3.

Reinforcing bars may be relocated to avoid interference with other reinforcement, or with conduit, pipe, or other embedded items. If any reinforcing bar is moved a distance exceeding one bar diameter or specified placing tolerance, resulting rearrangement of reinforcement is subject to approval.

#### 3.6.13 Concrete Protection for Reinforcement

Concrete protection must be in accordance with the ACI/MCP-4, ASTM E 648, and ACI/MCP-3.

#### 3.6.14 Welding

Welding must be in accordance with AWS D1.4/D1.4M.

### 3.7 BATCHING, MEASURING, MIXING, AND TRANSPORTING CONCRETE

ASTM C 94/C 94M, and ACI/MCP-2, except as modified herein. Batching equipment must be such that the concrete ingredients are consistently measured within the following tolerances: 1 percent for cement and water, 2 percent for aggregate, and 3 percent for admixtures. Furnish mandatory batch ticket information for each load of ready mix concrete.

#### 3.7.1 Measuring

Make measurements at intervals as specified in paragraphs entitled "Sampling" and "Testing."

#### 3.7.2 Mixing

ASTM C 94/C 94M and ACI/MCP-2. Machine mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 84 degrees F. Reduce mixing time and place concrete within 60 minutes if the air temperature is greater than 84 degrees F except as follows: if set retarding admixture is used and slump requirements can be met, limit for placing concrete may remain at 90 minutes. Additional water may be added, provided that both the specified maximum slump and water-cement ratio are not exceeded. When additional water is added, an additional 30 revolutions of the mixer at mixing speed is required. If the entrained air content falls below the specified limit, add a sufficient quantity of admixture to bring the entrained air content within the specified limits. Dissolve admixtures in the mixing water and mix in the drum to uniformly distribute the admixture throughout the batch.

#### 3.7.3 Transporting

Transport concrete from the mixer to the forms as rapidly as practicable. Prevent segregation or loss of ingredients. Clean transporting equipment thoroughly before each batch. Do not use aluminum pipe or chutes. Remove concrete which has segregated in transporting and dispose of as directed.

### 3.8 PLACING CONCRETE

Place concrete as soon as practicable after the forms and the reinforcement have been inspected and approved. Do not place concrete when weather conditions prevent proper placement and consolidation; in uncovered areas during periods of precipitation; or in standing water. Prior to placing concrete, remove dirt, construction debris, water, snow, and ice from within the forms. Deposit concrete as close as practicable to the final position in the forms. Do not exceed a free vertical drop of 3 feet from the point of discharge. Place concrete in one continuous operation from one end of the structure towards the other. Position grade stakes on 10 foot centers maximum in each direction when pouring interior slabs and on 20 foot centers maximum for exterior slabs.

#### 3.8.1 General Placing Requirements

Deposit concrete continuously or in layers of such thickness that no concrete is placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as specified.

Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic. Deposit concrete as nearly as practical in its final position to avoid segregation due to rehandling or flowing. Do not subject concrete to procedures which cause segregation.

Concrete to receive other construction must be screeded to proper level to avoid excessive skimming or grouting.

Do not use concrete which becomes nonplastic and unworkable or does not meet quality control limits as specified or has been contaminated by foreign materials. Use of retempered concrete is permitted. Remove rejected concrete from the site.

### 3.8.2 Footing Placement

Concrete for footings may be placed in excavations without forms upon inspection and approval by the Contracting Officer. Excavation width must be a minimum of 4 inches greater than indicated.

### 3.8.3 Vibration

ACI/MCP-2. Furnish a spare, working, vibrator on the job site whenever concrete is placed. Consolidate concrete slabs greater than 4 inches in depth with high frequency mechanical vibrating equipment supplemented by hand spading and tamping. Consolidate concrete slabs 4 inches or less in depth by wood tampers, spading, and settling with a heavy leveling straightedge. Operate internal vibrators with vibratory element submerged in the concrete, with a minimum frequency of not less than 6000 impulses per minute when submerged. Do not use vibrators to transport the concrete in the forms. Insert and withdraw vibrators approximately 20 inches apart. Penetrate the previously placed lift with the vibrator when more than one lift is required. Place concrete in 20 inch maximum vertical lifts. Use external vibrators on the exterior surface of the forms when internal vibrators do not provide adequate consolidation of the concrete.

### 3.8.4 Application of Epoxy Bonding Compound

Apply a thin coat of compound to dry, clean surfaces. Scrub compound into the surface with a stiff-bristle brush. Place concrete while compound is stringy. Do not permit compound to harden prior to concrete placement. Follow manufacturer's instructions regarding safety and health precautions when working with epoxy resins.

### 3.8.5 Pumping

ACI/MCP-2. Pumping must not result in separation or loss of materials nor cause interruptions sufficient to permit loss of plasticity between successive increments. Loss of slump in pumping equipment must not exceed 2 inches. Do not convey concrete through pipe made of aluminum or aluminum alloy. Avoid rapid changes in pipe sizes. Limit maximum size of coarse aggregate to 33 percent of the diameter of the pipe. Limit maximum size of well rounded aggregate to 40 percent of the pipe diameter. Take samples for testing at both the point of delivery to the pump and at the discharge end.

### 3.8.6 Cold Weather

ACI/MCP-2. Do not allow concrete temperature to decrease below 50 degrees F. Obtain approval prior to placing concrete when the ambient temperature is below 40 degrees F or when concrete is likely to be subjected to freezing

temperatures within 24 hours. Cover concrete and provide sufficient heat to maintain 50 degrees F minimum adjacent to both the formwork and the structure while curing. Limit the rate of cooling to 37 degrees F in any 1 hour and 50 degrees F per 24 hours after heat application.

#### 3.8.7 Hot Weather

Maintain required concrete temperature using Figure 2.1.5 in ACI/MCP-2 to prevent the evaporation rate from exceeding 0.2 pound of water per square foot of exposed concrete per hour. Cool ingredients before mixing or use other suitable means to control concrete temperature and prevent rapid drying of newly placed concrete. Shade the fresh concrete as soon as possible after placing. Start curing when the surface of the fresh concrete is sufficiently hard to permit curing without damage. Provide water hoses, pipes, spraying equipment, and water hauling equipment, where job site is remote to water source, to maintain a moist concrete surface throughout the curing period. Provide burlap cover or other suitable, permeable material with fog spray or continuous wetting of the concrete when weather conditions prevent the use of either liquid membrane curing compound or impervious sheets. For vertical surfaces, protect forms from direct sunlight and add water to top of structure once concrete is set.

#### 3.8.8 Follow-up

Check concrete within 24 hours of placement for flatness, levelness, and other specified tolerances. Adjust formwork and placement techniques on subsequent pours to achieve specified tolerances.

#### 3.8.9 Placing Concrete in Forms

Deposit concrete placed in forms in horizontal layers not exceeding 24 inches.

Remove temporary spreaders in forms when concrete placing has reached elevation of spreaders.

Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Design vibrators to operate with vibratory element submerged in concrete and maintain a speed of not less than 9,000 impulses per minute when submerged in concrete. Provide vibrating equipment adequate in number of units and power of each unit to properly consolidate concrete. Vibration of forms and reinforcement is not be permitted. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced points not farther apart than visible effectiveness of machine. Do not insert vibrator into lower courses of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of concrete mix.

Do not start placing of concrete in supporting elements until concrete previously placed in columns and walls is no longer plastic and has been in place a minimum of 2 hours.

#### 3.8.10 Placing Concrete Slabs

Place and consolidate concrete for slabs in a continuous operation, within the limits of approved construction joints until placing of panel or section is completed.

During concrete placing operations, consolidate concrete by mechanical vibrating equipment so that concrete is worked around reinforcement and other embedded items and into corners. Consolidate concrete placed in beams and girders of supported slabs and against bulkheads of slabs on ground by mechanical vibrators as specified. Consolidate concrete in remainder of slabs by vibrating bridge screeds, roller pipe screeds, or other approved method. Limit consolidation operations to time necessary to obtain consolidation of concrete without bringing an excess of fine aggregate to the surface. Concrete to be consolidated must be as dry as practical and surfaces thereof must not be manipulated prior to finishing operations. Bring concrete correct level with a straightedge and struck-off. Use bull floats or darbies to smooth surface, leaving it free of humps or hollows. Sprinkling of water on plastic surface is not permitted.

Provide finish of slabs as specified.

#### 3.8.11 Bonding

Surfaces of set concrete at joints, except where bonding is obtained by use of concrete bonding agent, must be roughened and cleaned of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner that exposes the aggregate uniformly and does not leave laitance, loosened particles of aggregate, nor damaged concrete at the surface.

Obtain bonding of fresh concrete that has set as follows:

At joints between footings and walls or columns, between walls or columns and the beams or slabs they support, and elsewhere unless otherwise specified; roughened and cleaned surface of set concrete must be dampened, but not saturated, immediately prior to placing of fresh concrete.

At joints in exposed-to-view work; at vertical joints in walls; at joints near midpoint of span in girders, beams, supported slabs, other structural members; in work designed to contain liquids; the roughened and cleaned surface of set concrete must be dampened but not saturated and covered with a cement grout coating.

Provide cement grout that consists of equal parts of portland cement and fine aggregate by weight with not more than 6 gallons of water per sack of cement. Apply cement grout with a stiff broom or brush to a minimum thickness of 1/16 inch. Deposit fresh concrete before cement grout has attained its initial set.

Bonding of fresh concrete to concrete that has set may be obtained by use of a concrete bonding agent. Apply such bonding material to cleaned concrete surface in accordance with approved printed instructions of bonding material manufacturer.

### 3.9 SURFACE FINISHES EXCEPT FLOOR, SLAB, AND PAVEMENT FINISHES

#### 3.9.1 Defects

Repair formed surfaces by removing minor honeycombs, pits greater than 1 square inch surface area or 0.25 inch maximum depth, or otherwise defective areas. Provide edges perpendicular to the surface and patch with nonshrink grout. Patch tie holes and defects when the forms are removed. Concrete with extensive honeycomb including exposed steel reinforcement, cold

joints, entrapped debris, separated aggregate, or other defects which affect the serviceability or structural strength will be rejected, unless correction of defects is approved. Obtain approval of corrective action prior to repair. The surface of the concrete must not vary more than the allowable tolerances of ACI/MCP-4. Exposed surfaces must be uniform in appearance and finished to a smooth form finish unless otherwise specified.

### 3.9.2 Not Against Forms (Top of Walls)

Surfaces not otherwise specified must be finished with wood floats to even surfaces. Finish must match adjacent finishes.

### 3.9.3 Formed Surfaces

#### 3.9.3.1 Tolerances

ACI/MCP-1 and as indicated.

#### 3.9.3.2 As-Cast Rough Form

Provide for surfaces not exposed to public view. Patch these holes and defects and level abrupt irregularities. Remove or rub off fins and other projections exceeding 0.25 inch in height.

#### 3.9.3.3 Standard Smooth Finish

Finish must be as-cast concrete surface as obtained with form facing material for standard smooth finish. Repair and patch defective areas as specified; and all fins and remove other projections on surface.

### 3.10 FLOOR, SLAB, AND PAVEMENT FINISHES AND MISCELLANEOUS CONSTRUCTION

ACI/MCP-2, unless otherwise specified. Slope floors uniformly to drains where drains are provided. Where straightedge measurements are specified, Contractor must provide straightedge.

#### 3.10.1 Finish

Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater.

##### 3.10.1.1 Floated

Use for exterior slabs where not otherwise specified. After the concrete has been placed, consolidated, struck off, and leveled, do not work the concrete further, until ready for floating. Whether floating with a wood, magnesium, or composite hand float, with a bladed power trowel equipped with float shoes, or with a powered disc, float must begin when the surface has stiffened sufficiently to permit the operation. During or after the first floating, check surface with a 10 foot straightedge applied at no less than two different angles, one of which is perpendicular to the direction of strike off. Cut down high spots and fill low spots during this procedure to produce a surface level within 1/4 inch in 10 feet.

#### 3.10.1.2 Steel Troweled

Use for floors intended as walking surfaces. First, provide a floated finish. Next, the finish must be power troweled two times, and finally hand troweled. The first troweling after floating needs to produce a smooth surface which is relatively free of defects but which may still show some trowel marks. Perform additional trowelings done by hand after the surface has hardened sufficiently. The final troweling is done when a ringing sound is produced as the trowel is moved over the surface. Thoroughly consolidate the surface by the hand troweling operations. The finished surface must be essentially free of trowel marks and uniform in texture and appearance. The finished surface must produce a surface level to within 1/4 inch in 10 feet.

#### 3.10.1.3 Broomed

Use on surfaces of exterior walks, platforms, patios, and ramps, unless otherwise indicated. Perform a floated finish, then draw a broom or burlap belt across the surface to produce a coarse scored texture. Permit surface to harden sufficiently to retain the scoring or ridges. Broom transverse to traffic or at right angles to the slope of the slab.

#### 3.10.1.4 Pavement

Screed the concrete with a template advanced with a combined longitudinal and crosswise motion. Maintain a slight surplus of concrete ahead of the template. After screeding, float the concrete longitudinally. Use a straightedge to check slope and flatness; correct and refloat as necessary. Obtain final finish by belting or burlap drag at the Contractor's option. Lay belt flat on the concrete surface and advance with a sawing motion; continue until a uniform but gritty nonslip surface is obtained. OR drag a strip of clean, wet burlap from 3 to 10 feet wide and 2 feet longer than the pavement width across the slab. Produce a fine, granular, sandy textured surface without disfiguring marks. Round edges and joints with an edger having a radius of 1/8 inch.

#### 3.10.2 Concrete Walks

Provide 4 inches thick minimum. Provide contraction joints spaced every 5 linear feet unless otherwise indicated. Cut contraction joints one inch deep with a jointing tool after the surface has been finished. Provide 0.5 inch thick transverse expansion joints at changes in direction where sidewalk abuts curb, steps, rigid pavement, or other similar structures; space expansion joints every 50 feet maximum. Give walks a broomed finish. Unless indicated otherwise, provide a transverse slope of 1/48. Limit variation in cross section to 1/4 inch in 5 feet.

#### 3.10.3 Pits and Trenches

Place bottoms and walls monolithically or provide waterstops and keys.

#### 3.10.4 Curbs and Gutters

Provide contraction joints spaced every 10 feet maximum unless otherwise indicated. Cut contraction joints 3/4 inch deep with a jointing tool after the surface has been finished. Provide expansion joints 1/2 inch thick and spaced every 100 feet maximum unless otherwise indicated. Perform pavement finish.

### 3.10.5 Splash Blocks

Provide at outlets of downspouts emptying at grade. Splash blocks may be precast concrete, and must be 24 inches long, 12 inches wide, and 4 inches thick, unless otherwise indicated, with smooth-finished countersunk dishes sloped to drain away from the building.

### 3.11 CURING AND PROTECTION

ACI/MCP-2 unless otherwise specified. Begin curing immediately following form removal. Avoid damage to concrete from vibration created by blasting, pile driving, movement of equipment in the vicinity, disturbance of formwork or protruding reinforcement, and any other activity resulting in ground vibrations. Protect concrete from injurious action by sun, rain, flowing water, frost, mechanical injury, tire marks, and oil stains. Do not allow concrete to dry out from time of placement until the expiration of the specified curing period. Do not use membrane-forming compound on surfaces where appearance would be objectionable, on any surface to be painted, where coverings are to be bonded to the concrete, or on concrete to which other concrete is to be bonded. If forms are removed prior to the expiration of the curing period, provide another curing procedure specified herein for the remaining portion of the curing period.

#### 3.11.1 General

Protect freshly placed concrete from premature drying and cold or hot temperature and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of cement and proper hardening of concrete.

Start initial curing as soon as free water has disappeared from surface of concrete after placing and finishing. Keep concrete moist for minimum 72 hours.

Final curing must immediately follow initial curing and before concrete has dried. Continue final curing until cumulative number of hours or fraction thereof (not necessarily consecutive) during which temperature of air in contact with the concrete is above 50 degrees F has totaled 168 hours. Alternatively, if tests are made of cylinders kept adjacent to the structure and cured by the same methods, final curing may be terminated when the average compressive strength has reached 70 percent of the 28-day design compressive strength. Prevent rapid drying at end of final curing period.

#### 3.11.2 Moist Curing

Remove water without erosion or damage to the structure. Prevent water run-off.

##### 3.11.2.1 Ponding or Immersion

Continually immerse the concrete throughout the curing period. Water must not be more than 50 degrees F less than the temperature of the concrete. For temperatures between 40 and 50 degrees F, increase the curing period by 50 percent.

##### 3.11.2.2 Fog Spraying or Sprinkling

Apply water uniformly and continuously throughout the curing period. For

temperatures between 40 and 50 degrees F, increase the curing period by 50 percent.

#### 3.11.2.3 Pervious Sheeting

Completely cover surface and edges of the concrete with two thicknesses of wet sheeting. Overlap sheeting 6 inches over adjacent sheeting. Provide sheeting that is at least as long as the width of the surface to be cured. During application, do not drag the sheeting over the finished concrete nor over sheeting already placed. Wet sheeting thoroughly and keep continuously wet throughout the curing period.

#### 3.11.2.4 Impervious Sheeting

Wet the entire exposed surface of the concrete thoroughly with a fine spray of water and cover with impervious sheeting throughout the curing period. Lay sheeting directly on the concrete surface and overlap edges 12 inches minimum. Provide sheeting not less than 18 inches wider than the concrete surface to be cured. Secure edges and transverse laps to form closed joints. Repair torn or damaged sheeting or provide new sheeting. Cover or wrap columns, walls, and other vertical structural elements from the top down with impervious sheeting; overlap and continuously tape sheeting joints; and introduce sufficient water to soak the entire surface prior to completely enclosing.

#### 3.11.3 Liquid Membrane-Forming Curing Compound

Seal or cover joint openings prior to application of curing compound. Prevent curing compound from entering the joint. Apply in accordance with the recommendations of the manufacturer immediately after any water sheen which may develop after finishing has disappeared from the concrete surface. Provide and maintain compound on the concrete surface throughout the curing period. Do not use this method of curing where the use of Figure 2.1.5 in ACI/MCP-2 indicates that hot weather conditions cause an evaporation rate exceeding 0.2 pound of water per square foot per hour.

##### 3.11.3.1 Application

Unless the manufacturer recommends otherwise, apply compound immediately after the surface loses its water sheen and has a dull appearance, and before joints are sawed. Mechanically agitate curing compound thoroughly during use. Use approved power-spraying equipment to uniformly apply two coats of compound in a continuous operation. The total coverage for the two coats must be 200 square feet maximum per gallon of undiluted compound unless otherwise recommended by the manufacturer's written instructions. The compound must form a uniform, continuous, coherent film that does not check, crack, or peel. Immediately apply an additional coat of compound to areas where the film is defective. Re-spray concrete surfaces subjected to rainfall within 3 hours after the curing compound application.

##### 3.11.3.2 Protection of Treated Surfaces

Prohibit pedestrian and vehicular traffic and other sources of abrasion at least 72 hours after compound application. Maintain continuity of the coating for the entire curing period and immediately repair any damage.

##### 3.11.4 Curing Periods

ACI/MCP-2 except 10 days for retaining walls or pavements, 21 days for

concrete that is in full-time or intermittent contact with seawater, salt spray, alkali soil or waters. Begin curing immediately after placement. Protect concrete from premature drying, excessively hot temperatures, and mechanical injury; and maintain minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing are subject to approval by the Contracting Officer.

### 3.11.5 Curing Methods

Accomplish curing by moist curing, by moisture-retaining cover curing, by membrane curing, and by combinations thereof, as specified.

Moist curing:

Accomplish moisture curing by any of the following methods:

Keeping surface of concrete wet by covering with water

Continuous water spraying

Covering concrete surface with specified absorptive cover for curing concrete saturated with water and keeping absorptive cover wet by water spraying or intermittent hosing. Place absorptive cover to provide coverage of concrete surfaces and edges with a slight overlap over adjacent absorptive covers.

Moisture-cover curing:

Accomplish moisture-retaining cover curing by covering concrete surfaces with specified moisture-retaining cover for curing concrete. Place cover directly on concrete in widest practical width, with sides and ends lapped at least 3 inches. Weight cover to prevent displacement; immediately repair tears or holes appearing during curing period by patching with pressure-sensitive, waterproof tape or other approved method.

Membrane curing:

Accomplish membrane curing by applying specified membrane-forming curing compound to damp concrete surfaces as soon as moisture film has disappeared. Apply curing compound uniformly in a two-coat operation by power-spraying equipment using a spray nozzle equipped with a wind guard. Apply second coat in a direction at right angles to direction of first coat. Total coverage for two coats must be not more than 200 square feet per gallon of curing compound. Respray concrete surfaces which are subjected to heavy rainfall within 3 hours after curing compound has been applied by method and at rate specified. Maintain continuity of coating for entire curing period and immediately repair damage to coating during this period.

Membrane-curing compounds must not be used on surfaces that are to be covered with coating material applied directly to concrete or with a covering material bonded to concrete, such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, painting, and other coatings and finish materials.

### 3.11.6 Curing Formed Surfaces

Accomplish curing of formed surfaces, including undersurfaces of girders, beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed before end of curing period, accomplish final curing of formed surfaces by any of the curing methods specified above, as applicable.

### 3.11.7 Curing Unformed Surfaces

Accomplish initial curing of unformed surfaces, such as monolithic slabs, floor topping, and other flat surfaces, by membrane curing.

Unless otherwise specified, accomplish final curing of unformed surfaces by any of curing methods specified above, as applicable.

### 3.11.8 Temperature of Concrete During Curing

When temperature of atmosphere is 41 degrees F and below, maintain temperature of concrete at not less than 55 degrees F throughout concrete curing period or 45 degrees F when the curing period is measured by maturity. When necessary, make arrangements before start of concrete placing for heating, covering, insulation, or housing as required to maintain specified temperature and moisture conditions for concrete during curing period.

When the temperature of atmosphere is 80 degrees F and above or during other climatic conditions which cause too rapid drying of concrete, make arrangements before start of concrete placing for installation of wind breaks, of shading, and for fog spraying, wet sprinkling, or moisture-retaining covering of light color as required to protect concrete during curing period.

Changes in temperature of concrete must be uniform and not exceed 37 degrees F in any 1 hour nor 80 degrees F in any 24-hour period.

### 3.11.9 Protection from Mechanical Injury

During curing period, protect concrete from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration and from damage caused by rain or running water.

### 3.11.10 Protection After Curing

Protect finished concrete surfaces from damage by construction operations.

## 3.12 FIELD QUALITY CONTROL

### 3.12.1 Sampling

ASTM C 172. Collect samples of fresh concrete to perform tests specified. ASTM C 31/C 31M for making test specimens.

### 3.12.2 Testing

#### 3.12.2.1 Slump Tests

ASTM C 143/C 143M. Take concrete samples during concrete placement. The maximum slump may be increased as specified with the addition of an

approved admixture provided that the water-cement ratio is not exceeded. Perform tests at commencement of concrete placement, when test cylinders or beams are made, and for each batch (minimum) or every 20 cubic yards (maximum) of concrete.

#### 3.12.2.2 Temperature Tests

Test the concrete delivered and the concrete in the forms. Perform tests in hot or cold weather conditions (below 50 degrees F and above 80 degrees F) for each batch (minimum) or every 20 cubic yards (maximum) of concrete, until the specified temperature is obtained, and whenever test cylinders or beams and slump tests are made.

#### 3.12.2.3 Compressive Strength Tests

ASTM C 39/C 39M. Make five test cylinders for each set of tests in accordance with ASTM C 31/C 31M. Take precautions to prevent evaporation and loss of water from the specimen. Test two cylinders at 7 days, two cylinders at 28 days, and hold one cylinder in reserve. Take samples for strength tests of each mix design of concrete placed each day not less than once a day, nor less than once for each 100 cubic yards of concrete, nor less than once for each 5000 square feet of surface area for slabs or walls. For the entire project, take no less than five sets of samples and perform strength tests for each mix design of concrete placed. Each strength test result must be the average of two cylinders from the same concrete sample tested at 28 days. If the average of any three consecutive strength test results is less than f'c or if any strength test result falls below f'c by more than 450 psi, take a minimum of three ASTM C 42/C 42M core samples from the in-place work represented by the low test cylinder results and test. Concrete represented by core test is considered structurally adequate if the average of three cores is equal to at least 85 percent of f'c and if no single core is less than 75 percent of f'c. Retest locations represented by erratic core strengths. Remove concrete not meeting strength criteria and provide new acceptable concrete. Repair core holes with nonshrink grout. Match color and finish of adjacent concrete.

#### 3.12.2.4 Air Content

ASTM C 173/C 173M or ASTM C 231 for normal weight concrete. Test air-entrained concrete for air content at the same frequency as specified for slump tests.

#### 3.12.2.5 Strength of Concrete Structure

Compliance with the following is considered deficient if it fails to meet the requirements which control strength of structure in place, including following conditions:

Failure to meet compressive tests as evaluated

Reinforcement not conforming to requirements specified

Concrete which differs from required dimensions or location in such a manner as to reduce strength

Concrete curing and protection of concrete against extremes of temperature during curing, not conforming to requirements specified

Concrete subjected to damaging mechanical disturbances, particularly

load stresses, heavy shock, and excessive vibration

Poor workmanship likely to result in deficient strength

#### 3.12.2.6 Testing Concrete Structure for Strength

When there is evidence that strength of concrete structure in place does not meet specification requirements, make cores drilled from hardened concrete for compressive strength determination in accordance with ASTM C 42/C 42M, and as follows:

Take at least three representative cores from each member or area of concrete-in-place that is considered potentially deficient. Location of cores will be determined by the Contracting Officer.

Test cores after moisture conditioning in accordance with ASTM C 42/C 42M if concrete they represent is more than superficially wet under service.

Air dry cores, (60 to 80 degrees F with relative humidity less than 60 percent) for 7 days before test and test dry if concrete they represent is dry under service conditions.

Strength of cores from each member or area are considered satisfactory if their average is equal to or greater than 85 percent of the 28-day design compressive or flexural strength of the class of concrete.

Core specimens will be taken and tested by the Government. If the results of core-boring tests indicate that the concrete as placed does not conform to the drawings and specification, the cost of such tests and restoration required must be borne by the Contractor.

Fill core holes solid with patching mortar and finished to match adjacent concrete surfaces.

Correct concrete work that is found inadequate by core tests in a manner approved by the Contracting Officer.

#### 3.13 WASTE MANAGEMENT

As specified in the Waste Management Plan and as follows.

##### 3.13.1 Mixing Equipment

Before concrete pours, designate Company-owned site meeting environmental standards or an on-site area to be paved later in project for cleaning out concrete mixing trucks. Minimize water used to wash equipment.

##### 3.13.2 Hardened, Cured Waste Concrete

Crush and reuse hardened, cured waste concrete as fill or as a base course for pavement. Use hardened, cured waste concrete as aggregate in concrete mix if approved by Contracting Officer.

##### 3.13.3 Reinforcing Steel

Collect reinforcing steel and place in designated area for recycling.

#### 3.13.4 Other Waste

Identify concrete manufacturer's or supplier's policy for collection or return of construction waste, unused material, deconstruction waste, and/or packaging material. Return excess cement to supplier. Institute deconstruction and construction waste separation and recycling for use in manufacturer's programs. When such a program is not available, seek local recyclers to reclaim the materials.

#### 3.14 JOINTS

##### 3.14.1 Construction Joints

Make and locate joints not indicated so as not to impair strength and appearance of the structure, as approved. Locate construction joints as follows:

- a. In walls at not more than 60 feet in any horizontal direction; at top of footing; at top of slabs on ground; at top and bottom of door and window openings or where required to conform to architectural details; and at underside of deepest beam or girder framing into wall
- b. In columns or piers, at top of footing; at top of slabs on ground; and at underside of deepest beam or girder framing into column or pier
- c. Near midpoint of spans for supported slabs, beams, and girders unless a beam intersects a girder at the center, in which case construction joints in girder must offset a distance equal to twice the width of the beam. Make transfer of shear through construction joint by use of inclined reinforcement.
- d. In slabs on ground, so as to divide slab into areas not in excess of 1,200 square feet

Provide keyways at least 1-1/2-inches deep in construction joints in walls and slabs and between walls and footings; approved bulkheads may be used for slabs.

Joints must be perpendicular to main reinforcement. Reinforcement must be continued across construction joints.

##### 3.14.2 Waterstops

Provide waterstops in construction joints as indicated.

Install waterstops to form a continuous diaphragm in each joint. Make adequate provisions to support and protect waterstops during progress of work. Make field joints in waterstops in accordance with waterstop manufacturer's printed instructions, as approved. Protect waterstops protruding from joints from damage.

##### 3.14.3 Isolation Joints in Slabs on Ground

Provide joints at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

Fill joints with premolded joint filler strips 1/2 inch thick, extending full slab depth. Install filler strips at proper level below finish floor

elevation with a slightly tapered, dress-and-oiled wood strip temporarily secured to top of filler strip to form a groove not less than 3/4 inch in depth where joint is sealed with sealing compound and not less than 1/4 inch in depth where joint sealing is not required. Remove wood strip after concrete has set. Contractor must clean groove of foreign matter and loose particles after surface has dried.

#### 3.14.4 Control Joints in Slabs on Ground

Provide joints to form panels as indicated.

Under and on exact line of each control joint, cut 50 percent of welded wire fabric reinforcement before placing concrete.

Joints must be 1/8-inch wide by 1/5 to 1/4 of slab depth and formed by inserting hand-pressed fiberboard strip into fresh concrete until top surface of strip is flush with slab surface or by cutting the concrete with a saw after the concrete has set. After concrete has cured for at least 7 days, the Contractor must remove inserts and clean groove of foreign matter and loose particles.

#### 3.14.5 Sealing Joints in Slabs on Ground

Isolation and control joints which are to receive floor or pavement finish must be sealed with joint sealing compound after concrete curing period. Slightly underfill groove with joint sealing compound to prevent extrusion of compound. Remove excess material as soon after sealing as possible.

Sealing is not required for isolation and control joints to be covered with finish flooring material. Groove must be left ready to receive filling material that is provided as part of finish floor covering work.

### 3.15 INSTALLATION OF ANCHORAGE DEVICES

#### 3.15.1 General

Anchorage devices and embedded items required for other work that is attached to, or supported by, set and build in cast-in-place concrete as part of the work of this section, using setting drawings, instructions, and directions for work to be attached thereto.

#### 3.15.2 Placing Anchorage Devices

Anchorage devices and embedded items must be positioned accurately and supported against displacement. Fill openings in anchorage devices such as slots and threaded holes with an approved, removable material to prevent entry of concrete into openings.

### 3.16 CONCRETE CONVEYING

#### 3.16.1 Transfer of Concrete At Project Site

Handle concrete from point of delivery and transfer to concrete conveying equipment and to locations of final deposit as rapidly as practical by methods which prevent segregation and loss of concrete mix materials.

#### 3.16.2 Mechanical Equipment for Conveying Concrete

Equipment must ensure a continuous flow of concrete at delivery end, as

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approved. Provide runways for wheeled concrete-conveying equipment from concrete delivery point to locations of final deposit. Interior surfaces of concrete conveying equipment must be free of hardened concrete, debris, water, snow, ice, and other deleterious substances.

-- End of Section --

SECTION 05 50 13

MISCELLANEOUS METAL FABRICATIONS  
08/08

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.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303 (2005) Code of Standard Practice for Steel Buildings and Bridges

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.3 (2006) Operations - Safety Requirements for Powder Actuated Fastening Systems

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2008) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (1996; Addenda A 1999; Errata 2003; R 2005) Square and Hex Bolts and Screws (Inch Series)

ASME B18.2.2 (1987; R 2005) Standard for Square and Hex Nuts (Inch Series)

ASME B18.21.1 (1999; R 2005) Lock Washers (Inch Series)

ASME B18.22.1 (1965; R 2008) Plain Washers

ASME B18.6.2 (1998; R 2005) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws: Inch Series

ASME B18.6.3 (2003; R 2008) Machine Screws and Machine Screw Nuts

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M (2008) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153/A 153M (2005) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

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ASTM A 307	(2007b) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 36/A 36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A 47/A 47M	(2004) Standard Specification for Ferritic Malleable Iron Castings
ASTM A 500/A 500M	(2007) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 53/A 53M	(2007) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 653/A 653M	(2008) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 687	(1993) Standard Specification for High-Strength Nonheaded Steel Bolts and Studs
ASTM A 780	(2001; R 2006) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A 924/A 924M	(2008a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM D 1187	(1997; R 2002e1) Asphalt-Base Emulsions for Use as Protective Coatings for Metal
ASTM E 488	(1996; R 2003) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements

MASTER PAINTERS INSTITUTE (MPI)

MPI 79	(Jan 2004) Alkyd Anti-Corrosive Metal Primer
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THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 3	(2004; E 2004) Power Tool Cleaning
SSPC SP 6	(7) Commercial Blast Cleaning

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00

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SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Embedded Angles and plates, installation drawings; G

Guard posts (bollards/pipe guards); G

Submit fabrication drawings showing layout(s), connections to structural system, and anchoring details as specified in AISC 303.

1.3 QUALIFICATION OF WELDERS

Qualify welders in accordance with AWS D1.1/D1.1M. Use procedures, materials, and equipment of the type required for the work.

1.4 DELIVERY, STORAGE, AND PROTECTION

Protect from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather. Remove and replace damaged items with new items.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Structural Carbon Steel

ASTM A 36/A 36M.

2.1.2 Structural Tubing

ASTM A 500/A 500M.

2.1.3 Steel Pipe

ASTM A 53/A 53M, Type E or S, Grade B.

2.1.4 Fittings for Steel Pipe

Standard malleable iron fittings ASTM A 47/A 47M.

2.1.5 Anchor Bolts

ASTM A 307. Where exposed, shall be of the same material, color, and finish as the metal to which applied.

2.1.5.1 Expansion Anchors

Provide expansion anchors, size and minimum embedment as indicated. Minimum concrete or masonry embedment shall be as indicated. Design values listed shall be as tested according to ASTM E 488.

- a. Minimum allowable pullout value shall be as indicated.
- b. Minimum allowable shear value shall be as indicated.

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2.1.5.2 Bolts, Nuts, Studs and Rivets

ASME B18.2.2 and ASTM A 687 or ASTM A 307.

2.1.5.3 Powder Driven Fasteners

Follow safety provisions of ASSE/SAFE A10.3.

2.1.5.4 Screws

ASME B18.2.1, ASME B18.6.2, and ASME B18.6.3.

2.1.5.5 Washers

Provide plain washers to conform to ASME B18.22.1. Provide beveled washers for American Standard beams and channels, square or rectangular, tapered in thickness, and smooth. Provide lock washers to conform to ASME B18.21.1.

2.2 FABRICATION FINISHES

2.2.1 Galvanizing

Hot-dip galvanize items specified to be zinc-coated, after fabrication where practicable. Galvanizing: ASTM A 123/A 123M, ASTM A 153/A 153M, ASTM A 653/A 653M or ASTM A 924/A 924M, G90, as applicable.

2.2.2 Galvanize

Anchor bolts, grating fasteners, washers, and parts or devices necessary for proper installation, unless indicated otherwise.

2.2.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A 780 or by application of stick or thick paste material specifically designed for repair of galvanizing, as approved by Contracting Officer. Clean areas to be repaired and remove slag from welds. Heat surfaces to which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread molten material uniformly over surfaces to be coated and wipe off excess material.

2.2.4 Shop Cleaning and Painting

2.2.4.1 Surface Preparation

Blast clean surfaces in accordance with SSPC SP 6. Surfaces that will be exposed in spaces above ceiling or in attic spaces, crawl spaces, furred spaces, and chases may be cleaned in accordance with SSPC SP 3 in lieu of being blast cleaned. Wash cleaned surfaces which become contaminated with rust, dirt, oil, grease, or other contaminants with solvents until thoroughly clean. Steel to be embedded in concrete shall be free of dirt and grease. Do not paint or galvanize bearing surfaces, including contact surfaces within slip critical joints, but coat with rust preventative applied in the shop.

2.2.4.2 Pretreatment, Priming and Painting

Apply pretreatment, primer, and paint in accordance with manufacturer's

printed instructions.

### 2.3 GUARD POSTS (BOLLARDS/PIPE GUARDS)

Provide prime coated standard weight steel pipe as specified in ASTM A 53/A 53M. Anchor posts in concrete as indicated and fill solidly with concrete with minimum compressive strength of 4000 psi.

### 2.4 EMBEDDED ANGLES AND PLATES

Provide angles and plates, ASTM A 36/A 36M, for embedment as indicated. Galvanize embedded items exposed to the elements according to ASTM A 123/A 123M.

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and harmonize with the material to which fastenings are applied. Include materials and parts necessary to complete each item, even though such work is not definitely shown or specified. Poor matching of holes for fasteners shall be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Form joints exposed to the weather shall be formed to exclude water.

### 3.2 WORKMANSHIP

Provide miscellaneous metalwork that is well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Provide continuous welding along the entire area of contact except where tack welding is permitted. Do not tack weld exposed connections of work in place and ground smooth. Provide a smooth finish on exposed surfaces of work in place and unless otherwise approved, flush exposed riveting. Mill joints where tight fits are required. Corner joints shall be coped or mitered, well formed, and in true alignment. Accurately set work to established lines and elevations and securely fastened in place. Install in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

### 3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

### 3.4 WELDING

Perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M. Use continuous welds on all exposed connections.

Grind visible welds smooth in the finished installation.

### 3.5 FINISHES

#### 3.5.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to MPI 79 to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with ASTM D 1187, asphalt-base emulsion.

#### 3.5.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Surfaces, when assembled, shall be free of rust, grease, dirt and other foreign matter.

#### 3.5.3 Environmental Conditions

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

### 3.6 INSTALLATION OF GUARD POSTS (BOLLARDS/PIPE GUARDS)

Set pipe guards vertically in concrete piers. Construct piers of, and the hollow cores of the pipe filled with, concrete having a compressive strength of 4000 psi.

-- End of Section --

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COMMON WORK RESULTS FOR ELECTRICAL  
**08/10**

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.

ASTM INTERNATIONAL (ASTM)

ASTM D 709 (2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100 (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA RN 1 (2005) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit

NEMA TC 2 (2003) Standard for Electrical Polyvinyl Chloride (PVC) Conduit

NEMA TC 3 (2004) Standard for Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2011) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 1 (2005; R 2007) Standard for Flexible Metal Conduit

UL 489 (2009) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

UL 6 (2007) Electrical Rigid Metal Conduit-Steel

UL 797 (2007) Electrical Metallic Tubing -- Steel

UL 870 (2008) Standard for Wireways, Auxiliary Gutters, and Associated Fittings

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1.2 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100.
- b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.
- c. Vertical assembly: A vertical assembly is a pole, tower or other such support, mounting hardware, arms, brackets and the load. Load can be a luminaire, siren, loudspeaker or other device. All components of a vertical assembly will be rated by the manufacturer to withstand 135 mph wind loading.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00  
SUBMITTAL PROCEDURES:

SD-03 Product Data

Submit manufacturer's catalog data for the following items:

Conduits, Raceway and Fittings; G  
Wire and Cable; G  
Splices and Connectors; G  
Pull Boxes; G  
Circuit Breakers; G  
Spare Parts

SD-06 Test Reports

Continuity Test

SD-08 Manufacturer's Instructions

Submit Manufacturer's Instructions.

1.4 PREVENTION OF CORROSION

Protect metallic materials against corrosion. Provide equipment enclosures with the standard finish by the manufacturer when used for most indoor installations. Do not use aluminum when in contact with earth or concrete and, where connected to dissimilar metal, protect by approved fittings and treatment. Ferrous metals such as, but not limited to, anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous spare parts not of corrosion-resistant steel shall be hot-dip galvanized except where other equivalent protective treatment is specifically approved in writing.

1.5 GENERAL REQUIREMENTS

Submit Manufacturer's Instructions including special provisions required to install equipment components and system packages. Special notices shall

detail impedances, hazards and safety precautions.

#### 1.6 POSTED OPERATING INSTRUCTIONS

Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

- a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
- b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
- c. Safety precautions.
- d. The procedure in the event of equipment failure.
- e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and be secured to prevent easy removal or peeling.

#### 1.7 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

#### 1.8 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

Materials and equipment to be provided shall be the standard cataloged products of manufacturers regularly engaged in the manufacture of the products.

##### 2.1.1 Rigid Steel Conduit

Rigid steel conduit shall comply with UL 6 and be galvanized by the hot-dip process. Rigid steel conduit shall be polyvinylchloride (PVC) coated in accordance with NEMA RN 1, where underground and in corrosive areas, or

must be painted with bitumastic.

Fittings for rigid steel conduit shall be threaded.

Gaskets shall be solid. Conduit fittings with blank covers shall have gaskets, except in clean, dry areas or at the lowest point of a conduit run where drainage is required.

Covers shall have captive screws and be accessible after the work has been completed.

#### 2.1.2 Electrical Metallic Tubing (EMT)

EMT shall be in accordance with UL 797 and be zinc coated steel. Couplings and connectors shall be zinc-coated, raintight, gland compression with insulation throat. Crimp, spring, or setscrew type fittings are not acceptable.

#### 2.1.3 Flexible Metallic Conduit

Flexible metallic conduit shall comply with UL 1 and be galvanized steel.

Fittings for flexible metallic conduit shall be specifically designed for such conduit.

Provide liquidtight flexible metallic conduit with a protective jacket of PVC extruded over a flexible interlocked galvanized steel core to protect wiring against moisture, oil, chemicals, and corrosive fumes.

Specifically design fittings for liquidtight flexible metallic conduit for such conduit.

#### 2.1.4 Rigid Nonmetallic Conduit

Rigid nonmetallic conduit shall comply with NEMA TC 2 and NEMA TC 3 with wall thickness not less than Schedule 40.

#### 2.1.5 Wireways and Auxiliary Gutters

Wireway and auxiliary gutters shall be a minimum 4- by 4 inch trade size conforming to UL 870.

### 2.2 WIRE AND CABLE

Conductors installed in conduit shall be copper 600-volt type THHN THWN. All conductors AWG No. 8 and larger, shall be stranded. All conductors smaller than AWG No. 8 shall be stranded.

### 2.3 SPLICES AND CONNECTORS

Make all splices in AWG No. 8 and smaller with approved indentor crimp-type connectors and compression tools.

Make all splices in AWG No. 6 and larger with bolted clamp-type connectors. Joints shall be wrapped with an insulating tape that has an insulation and temperature rating equivalent to that of the conductor.

## 2.4 PULL BOXES

Furnish all pull and junction boxes with screw-fastened covers.

## 2.5 CIRCUIT BREAKERS

Circuit-breaker interrupting rating shall be not less than those indicated and in no event less than 10,000 amperes root-mean-square (rms) symmetrical at 208 volts, respectively. Multipole circuit breakers shall be the common-trip type with a single handle. Molded case circuit breakers shall be bolt-on type conforming to UL 489.

## PART 3 EXECUTION

### 3.1 CONDUITS, RACEWAYS AND FITTINGS

Do not install crushed or deformed conduit. Avoid trapped conduit runs where possible. Take care to prevent the lodgment of foreign material in the conduit, boxes, fittings, and equipment during the course of construction. Clear any clogged conduit of obstructions or be replaced.

Conduit and raceway runs concealed in or behind walls, above ceilings, or exposed on walls and ceilings 5 feet or more above finished floors and not subject to mechanical damage may be electrical metallic tubing (EMT).

#### 3.1.1 Rigid Steel Conduit

Make field-made bends and offsets with approved hickey or conduit bending machine. Conduit elbows larger than 2-1/2 inches shall be long radius.

#### 3.1.2 Electrical Metallic Tubing (EMT)

EMT shall be grounded in accordance with NFPA 70, using pressure grounding connectors especially designed for EMT.

#### 3.1.3 Flexible Metallic Conduit

Bonding wires shall be used in flexible conduit as specified in NFPA 70, for all circuits. Flexible conduit shall not be considered a ground conductor.

Electrical connections to vibration-isolated equipment shall be made with flexible metallic conduit.

Liquidtight flexible metallic conduit shall be used in wet and oily locations and to complete the connection to motor-driven equipment.

#### 3.1.4 Rigid Nonmetallic Conduit

Rigid PVC conduit shall be direct buried.

A green insulated copper grounding conductor shall be in conduit with conductors and be solidly connected to ground at each end. Grounding wires shall be sized in accordance with NFPA 70.

#### 3.1.5 Surface Raceways and Assemblies

Surface raceways shall be mounted plumb and level, with the base and cover secured. Minimum circuit run shall be three-wire with one wire designated

as ground.

### 3.2 WIRING

Feeder and branch circuit conductors shall be color coded as follows:

<u>CONDUCTOR</u>	<u>COLOR 208/120V AC</u>	<u>COLOR 480/277 AC</u>
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	White
Equipment Grounds	Green	Green

Conductors up to and including AWG No. 2 shall be manufactured with colored insulating materials. Conductors larger than AWG No. 2 shall have ends identified with color plastic tape in outlet, pull, or junction boxes.

Splice in accordance with the NFPA 70. Provide conductor identification within each enclosure where a tap, splice, or termination is made and at the equipment terminal of each conductor. Terminal and conductor identification shall match as indicated.

Where several feeders pass through a common pullbox, the feeders shall be tagged to clearly indicate the electrical characteristics, circuit number, and panel designation.

### 3.3 IDENTIFICATION PLATES AND WARNINGS

Furnish and install identification plates for disconnect switches.

### 3.4 FIELD TESTING

Submit Test Reports in accordance with referenced standards in this section.

After completion of the installation and splicing, and prior to energizing the conductors, perform wire and cable continuity as herein specified before the conductors are energized.

Contractor shall provide all necessary test equipment, labor, and personnel to perform the tests, as herein specified.

Isolate completely all wire and cable from all extraneous electrical connections at cable terminations and joints. Circuit breakers in panel boards, and other disconnecting devices shall be used to isolate the circuits under test.

Perform Continuity Test to insure correct cable connection (i.e correct phase conductor, grounded conductor, and grounding conductor wiring) end-to-end. Any damages to existing or new electrical equipment resulting from contractor mis-wiring will be repaired and re-verified at contractor's expense. All repairs shall be approved by the CO prior to acceptance of the repair.

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Final acceptance will depend upon the successful performance of wire and cable under test. Do not energize any conductor until the final test reports are reviewed and approved by the CO.

-- End of Section --

SECTION 28 31 76

FIRE ALARM SYSTEM  
11/08

PART 1 GENERAL

1.1 RELATED SECTIONS

Section 26 05 00.00 40 COMMON WORK RESULTS FOR ELECTRICAL, applies to this section, with the additions and modifications specified herein.

1.2 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.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S3.2 (2009) Method for Measuring the  
Intelligibility of Speech Over  
Communication Systems (ASA 85)

ASME INTERNATIONAL (ASME)

ASME A17.1/CSA B44 (2007; Addenda a 2008) Safety Code for  
Elevators and Escalators

FM GLOBAL (FM)

FM APP GUIDE (updated on-line) Approval Guide  
[http://www.approvalguide.com/CC\\_host/pages/public/custom](http://www.approvalguide.com/CC_host/pages/public/custom)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1 (2002; R 2008) Guide on the Surges  
Environment in Low-Voltage (1000 V and  
Less) AC Power Circuits

IEEE C62.41.2 (2002) Recommended Practice on  
Characterization of Surges in Low-Voltage  
(1000 V and Less) AC Power Circuits

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 60268-16 (2003) Sound System Equipment - Part 16:  
Objective Rating Of Speech Intelligibility  
By Speech Transmission Index; Ed 3.0

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 7240-16 (2007) Fire Detection And Alarm Systems -  
Part 16: Sound System Control And  
Indicating Equipment

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

NASA-STD-8719.11 Rev. A (2008) Safety Standard For Fire Protection

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101 (2009; TIA 09-1; TIA 09-2) Life Safety Code

NFPA 170 (2009) Standard for Fire Safety and  
Emergency Symbols

NFPA 221 (2012) Standard for High Challenge Fire  
Walls, Fire Walls, and Fire Barrier Walls

NFPA 251 (2006) Standard Methods of Tests of Fire  
Resistance of Building Construction and  
Materials

NFPA 241 (2009) Standard for Safeguarding  
Construction, Alteration, and Demolition  
Operations

NFPA 70 (2011) National Electrical Code

NFPA 72 (2007; TIA 07-1; TIA 07-2) National Fire  
Alarm and Signaling Code

NFPA 90A (2009; Errata 09-1) Standard for the  
Installation of Air Conditioning and  
Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 1480 (2003; R 2010) Standard for Speakers for  
Fire Alarm, Emergency, and Commercial and  
Professional Use

UL 1638 (2001; R thru 2008) Visual Signaling  
Appliances - Private Mode Emergency and  
General Utility Signaling

UL 1971 (2002; R thru 2008) Signaling Devices for  
the Hearing Impaired

UL 2017 (2008; R 2009) General-Purpose Signaling  
Devices and Systems

UL 268 (2009) Smoke Detectors for Fire Alarm  
Systems

UL 268A (2008; R 2009) Smoke Detectors for Duct  
Application

UL 464 (2009) Standard for Audible Signal  
Appliances

UL 521 (1999; R thru 2010) Heat Detectors for

Fire Protective Signaling Systems

UL 864	(2003; R thru 20109) Standard for Control Units and Accessories for Fire Alarm Systems
UL Electrical Constructn	(2009) Electrical Construction Equipment Directory
UL Fire Prot Dir	(2010) Fire Protection Equipment Directory

1.3 DEFINITIONS

Wherever mentioned in this specification or on the drawings, the equipment, devices, and functions shall be defined as follows:

- a. Analog/Addressable System: A system where multiple signals are transmitted via the same conduction path to a remote fire alarm control unit and fire alarm control panel, decoded and separated so that each signal will initiate the specified response.
- b. Interface Device: An addressable device that interconnects hard wired systems or devices to an analog/addressable system.
- c. Remote Fire Alarm Unit: A control panel, electronically remote from the fire alarm control panel, that receives inputs from automatic and manual fire alarm devices; may supply power to detection devices and interface devices; may provide transfer of power to the notification appliances; may provide transfer of condition to relays or devices connected to the control unit; and reports to and receives signals from the fire alarm control panel.
- d. Fire Alarm (FACP): A master control panel having the features of a fire alarm control unit and fire alarm and mass notification control units are interconnected. The panel has central processing, memory, input and output terminals.
- e. Terminal Cabinet: A steel cabinet with locking, hinge-mounted door that terminal strips are securely mounted.

1.4 SYSTEM DESCRIPTION

1.4.1 Scope

- a. This work includes completion of design and providing a new, complete, analog/addressable fire alarm system as described herein and on the contract drawings for the Fire Water Infrastructure, EDM-1697. Include in the system wiring, raceways, pull boxes, terminal cabinets, outlet and mounting boxes, control equipment, alarm, and supervisory signal initiating devices, alarm notification appliances, and other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described. Provide system complete and ready for operation.
- b. Provide equipment, materials, installation, workmanship, inspection, and testing in strict accordance with the required and advisory provisions of NFPA 72, ISO 7240-16, IEC 60268-16, and

NASA-STD-8719.11 Rev. A except as modified herein. The system layouts on the drawings show the intent of coverage and are shown in suggested locations. Final quantity, system layout, and coordination are the responsibility of the Contractor. A single fire alarm control panel is indicated.

c. Where remote fire alarm control units are needed, they shall be provided at a terminal cabinet location. Each remote fire alarm control unit shall be powered from a wiring riser specifically for that use or from a local emergency power panel located on the same floor as the remote fire alarm control unit. Where remote fire control units are provided, equipment for notification appliances may be located in the remote fire alarm control units.

d. The fire alarm system shall be compatible with the existing SimplexGrinnell 4100U fire alarm panel at Post #1.

#### 1.4.2 Technical Data and Computer Software

Technical data and computer software (meaning technical data that relates to computer software) that are specifically identified in this project, and may be defined/required in other specifications, shall be delivered, strictly in accordance with the CONTRACT CLAUSES. Identify data delivered by reference to the particular specification paragraph against which it is furnished. Data to be submitted shall include complete system, equipment, and software descriptions. Descriptions shall show how the equipment will operate as a system to meet the performance requirements of this contract. The data package shall also include the following:

- a. Identification of programmable portions of system equipment and capabilities.
- b. Description of system revision and expansion capabilities and methods of implementation detailing both equipment and software requirements.
- c. Provision of operational software data on all modes of programmable portions of the fire alarm and detection system.
- d. Description of Fire Alarm Control Panel (FACP) equipment operation.
- e. Description of auxiliary and remote equipment operations.
- f. Library of application software.
- g. Operation and maintenance manuals.

#### 1.4.3 Keys

Keys and locks for equipment shall be identical. Provide not less than six keys of each type required.

#### 1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Annotated catalog data, in table format on the drawings, showing manufacturer's name, model, voltage, and catalog numbers for equipment and components. Submitted shop drawings shall not be smaller than ISO A1.

Wiring Diagrams; G

Point-to-point wiring diagrams showing the points of connection and terminals used for electrical field connections in the system, including interconnections between the equipment or systems that are supervised or controlled by the system. Diagrams shall show connections from field devices to the FACP and remote fire alarm control units, initiating circuits, switches, relays and terminals.

Complete riser diagrams indicating the wiring sequence of devices and their connections to the control equipment. Include a color code schedule for the wiring. Include floor plans showing the locations of devices and equipment.

System Layout; G

Plan view drawing showing device locations, terminal cabinet locations, junction boxes, other related equipment, conduit routing, wire counts, circuit identification in each conduit, and circuit layouts for all floors. Drawings shall comply with the requirements of NFPA 170 and NASA-STD-8719.11 Rev. A, Fire Safety Symbols.

System Operation; G

A complete list of device addresses and corresponding messages.

Notification Appliances; G

Data on each circuit to indicate that there is at least 25 percent spare capacity for notification appliances, 25 percent spare capacity for initiating devices. Annotate data for each circuit on the drawings.

Amplifiers; G

Data to indicate that the amplifiers have sufficient capacity to simultaneously drive all notification appliances at the maximum rating plus 50 percent spare capacity. Annotate data for each circuit on the drawings.

As-Built Drawings

Six sets of detailed as-built drawings. Furnish one set of full size paper as-built drawings and schematics. The drawings shall be prepared on uniform sized mylar sheets not less than 30 by 42

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inches with 8 by 4 inch title block similar to contract drawings. Furnish one set of CD or DVD discs containing software back-up and CAD based drawings in latest version of AutoCadd of as-built drawings and schematics. The drawings shall include complete wiring diagrams showing connections between devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as-built location of devices and equipment. The drawings shall show the system as installed, including deviations from both the project drawings and the approved shop drawings. These drawings shall be submitted within two weeks after the final acceptance test of the system. At least one set of as-built (marked-up) drawings shall be provided at the time of, or prior to the final acceptance test.

SD-03 Product Data

UL or FM listing cards for equipment provided.

Technical Data And Computer Software; G  
Fire Alarm Control Panel (FACP); G  
Terminal cabinets/assemblies; G  
Manual stations; G  
Batteries; G  
Battery chargers; G  
Smoke sensors; G  
Thermal sensors; G  
Wiring and cable; G  
Notification appliances; G  
Addressable interface devices; G  
Graphic annunciator; G  
Amplifiers; G  
Tone generators; G  
Digitalized voice generators; G  
Waterflow detectors; G  
Tamper switches; G  
Remote fire alarm control units; G

SD-05 Design Data

System Operation; G

A complete description of the system operation in matrix format on the drawings.

Battery power; G

Battery calculations as required in paragraph Battery Power Calculations.

SD-06 Test Reports

Field Quality Control  
Testing Procedures; G  
Smoke sensor testing procedures; G

SD-07 Certificates

## Installer

### SD-10 Operation and Maintenance Data

#### Operation and Maintenance (O&M) Instructions; G

Six copies of the Operation and Maintenance Instructions, indexed and in booklet form. The Operation and Maintenance Instructions shall be a single volume or in separate volumes, and may be submitted as a Technical Data Package. Manuals shall be approved prior to training.

Original and backup copies of all software delivered for this project, on each type of CD/DVD media utilized.

#### Instruction of Government Employees

The installers training history for the employees involved with this contract.

## 1.6 QUALITY ASSURANCE

Equipment and devices shall be compatible and operable with existing station fire alarm system and shall not impair reliability or operational functions of existing supervising station fire alarm system.

a. In NFPA publications referred to herein, consider advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; interpret reference to "authority having jurisdiction" to mean the Code SH AHJ or the Code SH Sr. Fire Protection Specialist.

b. The recommended practices stated in the manufacturer's literature or documentation shall be considered as mandatory requirements.

c. Devices and equipment for fire alarm service shall be listed by UL Fire Prot Dir or approved by FM APP GUIDE.

### 1.6.1 Qualifications

#### 1.6.1.1 Design Services

Installations requiring completion of installation drawings and specification or modifications of fire detection, fire alarm, fire suppression systems shall require the services and review of a qualified engineer. For the purposes of meeting this requirement, a qualified engineer is defined as an individual meeting one of the following conditions:

a. A registered professional engineer (P.E.) in fire protection engineering.

#### 1.6.1.2 Supervisor

The installing Contractor shall provide the following: NICET Fire Alarm Technicians to perform the installation of the system. A NICET Level 3 Fire Alarm Technician shall supervise the installation of the fire alarm system.

The Fire Alarm technicians supervising the installation of equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

#### 1.6.1.3 Technician

The installing Contractor shall provide the following: Fire Alarm Technicians with a minimum of four years of experience utilized to assist in the installation and terminate fire alarm, cabinets and panels. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

#### 1.6.1.4 Installer

The installing Contractor shall provide the following: Fire Alarm installer with a minimum of two years of experience utilized to assist in the installation of fire alarm devices, cabinets and panels. An electrician shall be allowed to install wire or cable and to install conduit for the fire alarm system/mass notification system. The Fire Alarm installer shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

#### 1.6.1.5 Test Personnel

The installing Contractor shall provide the following: Fire Alarm Technicians with a minimum of eight years of experience utilized to test and certify the installation of the fire alarm devices, cabinets and panels. The Fire Alarm technicians testing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

#### 1.6.1.6 Manufacturer's Representative

The fire alarm manufacturer's representative shall be present for the connection of wiring to the control panel. The Manufacturer's Representative shall be an employee of the manufacturer with necessary technical training on the system being installed.

#### 1.6.1.7 Manufacturer

Components shall be of current design and shall be in regular and recurrent production at the time of installation. Provide design, materials, and devices for a protected premises fire alarm system, complete, conforming to NFPA 72, except as otherwise or additionally specified herein.

### 1.6.2 Regulatory Requirements

#### 1.6.2.1 Requirements for Fire Protection Service

Equipment and material shall have been tested by UL and listed in UL Fire Prot Dir or approved by FM and listed in FM APP GUIDE. Where the terms "listed" or "approved" appear in this specification, they shall mean listed in UL Fire Prot Dir or FM APP GUIDE. The omission of these terms under the description of any item of equipment described shall not be construed as waiving this requirement. All listings or approval by testing laboratories shall be from an existing ANSI or UL published standard.

#### 1.6.2.3 Testing Services or Laboratories

Fire alarm and fire detection equipment shall be constructed in accordance with UL Fire Prot Dir, UL Electrical Constructn, or FM APP GUIDE.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity, and temperature variation, dirt and dust, and other contaminants.

#### 1.8 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS

The Interior Fire Alarm Operation and Maintenance Instructions shall include:

- a. "Manufacturer Data Package " as specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA.
- b. Operating manual outlining step-by-step procedures required for system startup, operation, and shutdown. The manual shall include the manufacturer's name, model number, service manual, parts list, and complete description of equipment and their basic operating features.
- c. Maintenance manual listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The manuals shall include conduit layout, equipment layout and simplified wiring, and control diagrams of the system as installed.
- d. The manuals shall include complete procedures for system revision and expansion, detailing both equipment and software requirements.
- e. Software delivered for this project shall be provided, on each type of CD/DVD media utilized.
- f. Printouts of configuration settings for all devices.
- g. Routine maintenance checklist. The routine maintenance checklist shall be arranged in a columnar format. The first column shall list all installed devices, the second column shall state the maintenance activity or state no maintenance required, the third column shall state the frequency of the maintenance activity, and the fourth column for additional comments or reference.

#### 1.9 EXTRA MATERIALS

##### 1.9.1 Repair Service/Replacement Parts

Repair services and replacement parts for the system shall be available for a period of 10 years after the date of final acceptance of this work by the Contracting Officer. During guarantee period, the service technician shall be on-site within 24 hours after notification. All repairs shall be completed within 24 hours of arrival on-site.

##### 1.9.2 Interchangeable Parts

Spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be

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suitably packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the Contracting Officer at the time of the final acceptance testing.

1.9.3 Spare Parts

Furnish the following spare parts and accessories:

- a. Four fuses for each fused circuit
- b. Nine spare reams of paper for the system printer, plus sufficient paper for fire alarm acceptance tests
- c. Three spare printer ribbons

1.9.4 Special Tools

Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and reprogramming of the equipment shall be furnished to the Contracting Officer.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

2.1.1 Standard Products

Provide materials, equipment, and devices that have been tested by a nationally recognized testing laboratory, such as UL or FM, and listed or approved for fire protection service when so required by NFPA 72 or this specification. Select material from one manufacturer, where possible, and not a combination of manufacturers, for any particular classification of materials. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least two years prior to bid opening.

2.1.2 Nameplates

Major components of equipment shall have the manufacturer's name, address, type or style, model or serial number, catalog number, date of installation, installing Contractor's name and address, and the contract number provided on a new plate permanently affixed to the item or equipment. Major components include, but are not limited to, the following:

- a. FACPs

Furnish nameplates to obtain approval by the Contracting Officer before installation. Obtain approval by the Contracting Officer for installation locations. Nameplates shall be etched metal or plastic, permanently attached by screws to panels or adjacent walls.

2.2 GENERAL PRODUCT REQUIREMENT

All fire alarm equipment shall be listed for use under the applicable reference standards. If a field modification is needed, such as adding equipment like relays, the manufacturer of the panels being same or different brand from manufacturer shall provide the installing contractor

for review and confirmation by the installing contractor. The installing contractor shall, as part of the submittal documents, provide this information.

### 2.3 SYSTEM OPERATION

The Addressable Interior Fire Alarm shall be a complete, supervised, noncoded, analog/addressable fire alarm system conforming to NFPA 72, UL 864 Ninth Edition, and UL 2017. The system shall be activated into the alarm mode by actuation of any alarm initiating device. The system shall remain in the alarm mode until the initiating device is reset and the fire alarm control panel is reset and restored to normal. The system may be placed in the alert mode by local microphones or remotely from authorized locations/users.

#### 2.3.1 Alarm Initiating Devices

Connect alarm initiating devices to initiating device circuits (IDC), Style B to signal line circuits (SLC), Style 4 and installed in accordance with NFPA 72. The system shall have an interconnected riser loop or network having Style 4 supervision for interconnection of other FA/MNS control panels.

a. Alarm notification appliances shall be connected to notification appliance circuits (NAC), Class A in accordance with NFPA 72. A looped conduit system shall be provided so that if the conduit and all conductors within are severed or exposed to fire at any point, all IDC, NAC and SLC will remain functional. Should the design or building layout preclude separation then a fire rated separation shall be provided in accordance with NFPA 72. The return portion of the loop shall be remote from the supply portion of the loop.

b. The system shall operate in the alarm mode upon actuation of any alarm initiating device. The system shall remain in the alarm mode until initiating device(s) are reset and the fire alarm control panel is manually reset and restored to normal. The conduit loop requirement is not applicable to the signal transmission link from the local panels (at the protected premises) to the Supervising Station (fire station, fire alarm central communication center). Audible, and visual appliances and systems shall comply with NFPA 72. Fire alarm system components requiring power, except for the control panel power supply, shall operate on 24 Volts dc.

#### 2.3.2 Functions and Operating Features

The system shall provide the following functions and operating features:

a. The FACP and fire alarm control units, if used, shall provide power, annunciation, supervision, and control for the system. Addressable systems shall be microcomputer (microprocessor or microcontroller) based with a minimum word size of eight bits with sufficient memory to perform as specified.

b. Provide class A circuits for all Initiating, Signal Line and Notification Appliance Circuits.

c. Provide Class A notification appliance circuits. The visual alarm

notification appliances shall have the flash rates synchronized.

d. Provide electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control panel.

e. Provide an audible and visual trouble signal to activate upon a single break or open condition, or ground fault. The trouble signal shall also operate upon loss of primary power (AC) supply, absence of a battery supply, low battery voltage, or removal of alarm or supervisory panel modules. Provide a trouble alarm silence feature that shall silence the audible trouble signal, without affecting the visual indicator. After the system returns to normal operating conditions, the trouble signal shall again sound until the trouble is acknowledged. A smoke sensor in the process of being verified for the actual presence of smoke shall not initiate a trouble condition.

f. Provide a notification appliance silencing switch, that when activated, will silence the audible signal appliance, but will not affect the visual alarm indicator, the liquid crystal display, or the automatic notification of the fire department. This switch shall be overridden upon activation of a subsequent alarm.

g. Provide alarm verification capability for smoke sensors. Alarm verification shall initially be set for 30 seconds.

h. Provide program capability via switches in a locked portion of the FACP to bypass the automatic notification appliance circuits, fire reporting system air handler shutdown door release features. Operation of this programming shall indicate this action on the FACP display and printer output.

i. Alarm, supervisory, and/or trouble signals shall be automatically transmitted to the fire department.

j. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.

k. The system shall be capable of being programmed from the panels keyboard. Programmed information shall be stored in non-volatile memory.

l. The system shall be capable of operating, supervising, and/or monitoring both addressable and non-addressable alarm and supervisory devices.

m. There shall be no limit, other than maximum system capacity, as to the number of addressable devices, that may be in alarm simultaneously.

n. Where the fire alarm system is responsible for initiating an action in another emergency control device or system, such as an HVAC system, the addressable fire alarm relay shall be within 3 feet of the emergency control device.

o. An alarm signal shall automatically initiate the following functions:

- (1) Transmission of an alarm signal to the base fire department.

(2) Visual indication of the device operated on the fire alarm control panel (FACP). Indication on the graphic annunciator shall be by floor, zone or circuit, and type of device.

(3) Recording of the event via the system printer and electronically in the history log of the fire control system unit.

(4) Release of power to electric locks on doors that are part of the means of egress.

(5) Operation of a duct smoke sensor shall shut down the appropriate air handler in accordance with NFPA 90A in addition to other requirements of this paragraph.

p. A supervisory signal shall automatically initiate the following functions:

(1) Visual indication of the device operated on the FACP, and sound the audible alarm at the respective panel.

(2) Transmission of a supervisory signal to the base fire department.

(3) Recording of the event via the system printer and electronically in the history log of the fire control system unit.

q. A trouble condition shall automatically initiate the following functions:

(1) Visual indication of the system trouble on the FACP, and sound the audible alarm at the respective panel.

(2) Transmission of a trouble signal to the fire base department.

(3) Recording of the event via the system printer.

r. The maximum permissible elapsed time between the actuation of an initiating device and its indication at the FACP shall be 10 seconds.

s. The maximum elapsed time between the occurrence of the trouble condition and its indication at the FACP shall not exceed 200 seconds.

## 2.4 SYSTEM MONITORING

### 2.4.1 Valves

Each valve affecting the proper operation of a fire protection system, including automatic sprinkler control valves, standpipe control valves, sprinkler service entrance valve, valves at fire pumps, isolating valves for pressure type waterflow or supervision switches, and valves at backflow preventers, whether supplied under this contract or existing, shall be electrically monitored to ensure its proper position. Each tamper switch shall be provided with a separate address, unless they are within the same room, then a maximum of five can use the same address.

## 2.6 OVERVOLTAGE AND SURGE PROTECTION

### 2.6.1 Signaling Line Circuit Surge Protection

For systems having circuits located outdoors, communications equipment shall be protected against surges induced on any signaling line circuit and shall comply with the applicable requirements of IEEE C62.41.1 and IEEE C62.41.2. Cables and conductors, that serve as communications links, shall have surge protection circuits installed at each end that meet the following waveform(s):

- a. A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8 microsecond by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes. Protection shall be provided at the equipment. Additional triple electrode gas surge protectors, rated for the application, shall be installed on each wireline circuit within 3 feet of the building cable entrance. Fuses shall not be used for surge protection.

### 2.6.2 Sensor Wiring Surge Protection

Digital and analog inputs and outputs shall be protected against surges induced by sensor wiring installed outdoors and as shown. The inputs and outputs shall be tested with the following waveforms:

- a. A 10 by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8 by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes. Fuses shall not be used for surge protection.

### 2.7 ADDRESSABLE INTERFACE DEVICES

The initiating device being monitored shall be configured as a Style B initiating device circuits. The system shall be capable of defining any module as an alarm module and report alarm trouble, loss of polling, or as a supervisory module, and reporting supervisory short, supervisory open or loss of polling such as waterflow switches, valve supervisory switches, fire pump monitoring, independent smoke detection systems, relays for output function actuation, etc. The module shall be UL or FM listed as compatible with the control panel. The monitor module shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. Monitor module shall contain an integral LED that flashes each time the monitor module is polled. Pull stations with a monitor module in a common backbox are not required to have an LED.

### 2.8 ADDRESSABLE CONTROL MODULE

The control module shall be capable of operating as a relay (dry contact form C) for interfacing the control panel with other systems, and to control door holders or initiate elevator fire service. The module shall be UL or FM listed as compatible with the control panel. The indicating device or the external load being controlled shall be configured as a Style Y notification appliance circuits. The system shall be capable of supervising, audible, visual and dry contact circuits. The control module shall have both an input and output address. The supervision shall detect a

short on the supervised circuit and shall prevent power from being applied to the circuit. The control model shall provide address setting means compatible with the control panel's SLC supervision and store an internal identifying code. The control module shall contain an integral LED that flashes each time the control module is polled. Control Modules shall be located in environmental areas that reflect the conditions to which they were listed.

## 2.10 SMOKE SENSORS

### 2.10.1 Photoelectric Smoke Sensors

Provide addressable photoelectric smoke sensors as follows:

- a. Provide analog/addressable photoelectric smoke sensors utilizing the photoelectric light scattering principle for operation in accordance with UL 268. Smoke sensors shall be listed for use with the fire alarm control panel.
- b. Provide self-restoring type sensors that do not require any readjustment after actuation at the FACP to restore them to normal operation. Sensors shall be UL listed as smoke-automatic fire sensors.
- c. Components shall be rust and corrosion resistant. Vibration shall have no effect on the sensor's operation. Protect the detection chamber with a fine mesh metallic screen that prevents the entrance of insects or airborne materials. The screen shall not inhibit the movement of smoke particles into the chamber.
- d. Provide twist lock bases for the sensors. The sensors shall maintain contact with their bases without the use of springs. Provide companion mounting base with screw terminals for each conductor. Terminate field wiring on the screw terminals. The sensor shall have a visual indicator to show actuation.
- e. The sensor address shall identify the particular unit, its location within the system, and its sensitivity setting. Sensors shall be of the low voltage type rated for use on a 24 VDC system.
- f. An operator at the control panel, having a proper access level, shall have the capability to manually access the following information for each initiating device.
  - (1) Primary status
  - (2) Device type
  - (3) Present average value
  - (4) Present sensitivity selected
  - (5) Sensor range (normal, dirty, etc.)

### 2.10.5 Smoke Sensor Testing

Smoke sensors shall be tested in accordance with NFPA 72 and manufacturer's recommended calibrated test method. Submit smoke sensor testing procedures

for approval.

## 2.11 THERMAL SENSORS

### 2.11.1 Heat Detectors

Heat detectors shall be designed for detection of fire by combination fixed temperature and rate-of-rise principle rate-compensating principle. The alarm condition shall be determined by comparing sensor value with the stored values. Heat detector spacing shall be rated in accordance with UL 521. Detectors located in areas subject to moisture, exterior atmospheric conditions, or hazardous locations as defined by NFPA 70, shall be types approved for such locations.

#### 2.11.1.1 Combination Fixed-Temperature and Rate-of-Rise Detectors

Detectors shall be designed for surface outlet box mounting and supported independently of wiring connections. Contacts shall be self-resetting after response to rate-of-rise principle. Under fixed temperature actuation, the detector shall have a permanent external indication that is readily visible. Detector units located in boiler rooms, showers, or other areas subject to abnormal temperature changes shall operate on fixed temperature principle only. The UL 521 test rating for the fixed temperature portion shall be 135 degrees F. The UL 521 test rating for the Rate-of-Rise detectors shall be rated for 50 by 50 feet.

#### 2.11.1.3 Fixed Temperature Detectors

Detectors shall be designed for surface outlet box mounting and supported independently of wiring connections. Detectors shall be designed to detect high heat. The detectors shall have a specific temperature setting of 135 degrees F. The UL 521 test rating for the fixed temperature detectors shall be rated for 15 by 15 feet.

### 2.11.2 Heat Sensing

A moving average of the sensors heat sensing value to automatically compensate for conditions that could affect detection operations. System shall automatically maintain a constant heat sensing sensitivity from each sensor by compensating for environmental factors.

### 2.11.3 Self-Test Routines

Automatic self-test routines shall be performed on each sensor that will functionally check sensor sensitivity electronics and ensure the accuracy of the value being transmitted. Any sensor that fails this test shall indicate a trouble condition with the sensor location at the control panel.

### 2.11.4 Operator Access

An operator at the control panel, having the proper access level, shall have the capability to manually access the following information for each heat sensor:

- a. Primary status
- b. Device type

- c. Present average value
- d. Sensor range

#### 2.11.5 Operator Control

An operator at the control panel, having the proper access level, shall have the capability to manually control the following information for each heat sensor:

- a. Alarm detection sensitivity values
- b. Enable or disable the point/device
- c. Control sensors relay driver output

#### 2.14 EMERGENCY POWER SUPPLY

Provide for system operation in the event of primary power source failure. Transfer from normal to auxiliary (secondary) power or restoration from auxiliary to normal power shall be automatic and shall not cause transmission of a false alarm.

##### 2.14.1 Batteries

Provide sealed, maintenance-free, batteries as the source for emergency power to the FACP. Batteries shall contain suspended electrolyte. The battery system shall be maintained in a fully charged condition by means of a solid state battery charger. Provide an automatic transfer switch to transfer the load to the batteries in the event of the failure of primary power.

###### 2.14.1.1 Capacity

Provide the batteries with sufficient capacity to operate the system under supervisory and trouble conditions, including audible trouble signal devices for 72 hours and audible and visual signal devices under alarm conditions for an additional 15 minutes.

###### 2.14.1.2 Battery Power Calculations

- a. Verify that battery capacity exceeds supervisory and alarm power requirements.
  - 1). Substantiate the battery calculations for alarm, alert, and supervisory power requirements. Ampere-hour requirements for each system component and each panel component, and the battery-recharging period shall be included.
  - 2). Provide complete battery calculations for both the alarm, alert, and supervisory power requirements. Ampere-hour requirements for each system component shall be submitted with the calculations.
  - 3). A voltage drop calculation to indicate that sufficient voltage is available for proper operation of the system and all components, at the minimum rated voltage of the system operating

on batteries.

b. For battery calculations use the following assumptions: Assume a starting voltage of 24 VDC for starting the calculations to size the batteries. Calculate the required Amp-Hours for the specified standby time, and then calculate the required Amp-Hours for the specified alarm time. Calculate the nominal battery voltage after operation on batteries for the specified time period. Using this voltage perform a voltage drop calculation for circuit containing device and/or appliances remote from the power sources.

#### 2.14.2 Battery Chargers

Provide a solid state, fully automatic, variable charging rate battery charger. The charger shall be capable of providing 150 percent of the connected system load and shall maintain the batteries at full charge. In the event the batteries are fully discharged (18 Volts dc), the charger shall recharge the batteries back to 95 percent of full charge within 48 hours. Provide pilot light to indicate when batteries are manually placed on a high rate of charge as part of the unit assembly if a high rate switch is provided.

#### 2.15 FIRE ALARM CONTROL PANEL (FACP)

Provide a complete control panel fully enclosed in a lockable steel enclosure as specified herein. Operations required for testing or for normal care and maintenance of the systems shall be performed from the front of the enclosure. If more than a single unit is required at a location to form a complete control panel, the unit enclosures shall match exactly.

a. Each control unit shall provide power, supervision, control, and logic for the entire system, utilizing solid state, modular components, internally mounted and arranged for easy access. Each control unit shall be suitable for operation on a 120 volt, 60 hertz, normal building power supply. Provide each panel with supervisory functions for power failure, internal component placement, and operation.

b. Visual indication of alarm, supervisory, or trouble initiation on the fire alarm control panel shall be by liquid crystal display or similar means with a minimum of 80 characters, that at least 32 are field changeable. Provide conductor integrity monitoring for strobe, display, temporary deactivation of fire alarm audible notification appliances and speaker wiring.

##### 2.15.1 Cabinet

Install control panel components in cabinets large enough to accommodate all components and also to allow ample gutter space for interconnection of panels as well as field wiring. The enclosure shall be identified by an engraved laminated phenolic resin nameplate. Lettering on the nameplate shall say "Fire Alarm Control Panel" and shall not be less than one inch high. Provide prominent rigid plastic or metal identification plates for lamps, circuits, meters, fuses, and switches. The cabinet shall be provided in a sturdy steel housing, complete with back box, hinged steel door with cylinder lock, and surface mounting provisions.

##### 2.15.2 Control Modules

Provide power and control modules to perform all functions of the FACP. Provide audible signals to indicate any alarm, supervisory, or trouble condition. The alarm signals shall be different from the trouble signal. Connect circuit conductors entering or leaving the panel to screw-type terminals with each terminal marked for identification. Locate diodes and relays, if any, on screw terminals in the FACP. Circuits operating at 24 VDC shall not operate at less than 21.6 volts. Circuits operating at any other voltage shall not have a voltage drop exceeding 10 percent of nominal voltage.

#### 2.15.3 Silencing Switches

a. Alarm Silencing Switch: Provide an alarm silencing switch at the FACP that shall silence the audible signal but not affect the visual alarm indicator. This switch shall be overridden upon activation of a subsequent alarm.

b. Supervisory/Trouble Silencing Switch: Provide supervisory and trouble silencing switch that shall silence the audible trouble and supervisory signal, but not extinguish the visual indicator. This switch shall be overridden upon activation of a subsequent alarm, supervision, or trouble condition. Audible trouble indication must resound automatically every 24 hours after the silencing feature has been operated.

#### 2.15.4 Non-Interfering

Power and supervise each circuit such that a signal from one device does not prevent the receipt of signals from any other device. Circuits shall be manually reset by switch from the FACP after the initiating device or devices have been restored to normal.

#### 2.15.6 Memory

Provide each control unit with non-volatile memory and logic for all functions. The use of long life batteries, capacitors, or other age-dependent devices shall not be considered as equal to non-volatile processors, PROMS, or EPROMS.

#### 2.15.7 Field Programmability

Provide control units and control panels that are fully field programmable for control, initiation, notification, supervisory, and trouble functions of both input and output. The system program configuration shall be menu driven. System changes shall be password protected and shall be accomplished using personal computer based equipment.

#### 2.15.8 Input/Output Modifications

The FACP shall contain features that allow the bypassing of input devices from the system or the modification of system outputs. These control features shall consist of a panel mounted keypad. Any bypass or modification to the system shall indicate a trouble condition on the FACP and a printed output of the trouble condition.

#### 2.15.9 Resetting

Provide the necessary controls to prevent the resetting of any alarm, supervisory, or trouble signal while the alarm, supervisory or trouble condition on the system still exists.

#### 2.15.10 Instructions

Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame. Install the instructions on the interior of the FACP. Install the frame in a conspicuous location observable from the FACP. The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, supervisory, and trouble. The instructions shall be approved by the Contracting Officer before being posted.

#### 2.15.11 Walk Test

The FACP shall have a walk test feature. When using this feature, operation of initiating devices shall result in limited system outputs, so that the notification appliances operate for only a few seconds and the event is indicated on the system printer, but no other outputs occur.

#### 2.15.12 History Logging

In addition to the required printer output, the control panel shall have the ability to store a minimum of 400 events in a log. These events shall be stored in a battery-protected memory and shall remain in the memory until the memory is downloaded or cleared manually. Resetting of the control panel shall not clear the memory.

#### 2.15.13 RS-232-C Output

Each local control panel shall be capable of operating remote service type cathode ray tubes (CRTs), printers, and/or modems. The output shall be paralleled ASCII from an EIA RS-232-C connection with a baud rate of 1200 or 2400 to allow use of any commonly available CRT, printer, or modem.

#### 2.15.14 Remote LED Text Display

An LED text display shall be provided at locations as shown on the drawings. The LED text display shall be at least 2 lines with a minimum of 20 characters per line. The size shall not exceed 16 inches length by 6 inches height by 3 inches deep. The text display shall as a minimum meet the following requirements:

- a. Two lines of information for high priority messaging.
- b. Minimum of 20 characters per line (40 total) displayed.
- c. Text shall be no less than 1/2 inch in height and readable from 1 foot to 20 feet away.
- d. 32K character memory.
- e. RS232 or RS485 serial interface included.
- f. Display shall be wall or ceiling mounted.

- g. Mounting brackets for a convenient wall/cubicle mount.
- h. During non-emergency periods, date and time shall be displayed.

#### 2.16 REMOTE FIRE ALARM CONTROL UNITS

Provide complete remote control units fully enclosed in a lockable steel enclosure as specified herein. Operations required for testing or for normal care and maintenance of the control units shall be performed from the front of the enclosure. If more than a single unit is required at a location to form a complete control panel, the unit enclosures shall match exactly. Each control unit shall provide power, supervision, control, and logic for its portion of the entire system, utilizing solid state, modular components, internally mounted and arranged for easy access. Each control unit shall be suitable for operation on a 120 volt, 60 hertz, normal building power supply. Provide each unit with supervisory functions for power failure, internal component placement, and operation.

##### 2.16.1 Cabinet

Install remote control unit components in cabinets large enough to accommodate components and also to allow ample gutter space for interconnection of units as well as field wiring. The enclosure shall be identified by an engraved laminated phenolic resin nameplate. Lettering on the nameplate shall be labeled "Remote Fire Alarm Control Unit" and shall not be less than one inch high. Provide prominent rigid plastic or metal identification plates for lamps, circuits, meters, fuses, and switches. The cabinet shall be provided in a sturdy steel housing, complete with back box, hinged steel door with cylinder lock, and surface mounting provisions.

##### 2.16.2 Control Modules

Provide power and control modules to perform all functions of the remote control unit. Provide audible signals to indicate any alarm or trouble condition. The alarm signals shall be different from the trouble signal. Connect circuit conductors entering or leaving the panel to screw-type terminals with each terminal marked for identification. Locate diodes and relays, if any, on screw terminals in the remote control unit. Circuits operating at 24 VDC shall not operate at less than 21.6 volts. Circuits operating at any other voltage shall not have a voltage drop exceeding 10 percent of nominal voltage. Circuits shall be arranged so that there is 25 percent spare capacity for any circuit.

##### 2.16.3 Silencing Switches

Provide an alarm silencing switch at the remote control unit that shall silence the audible signal but not affect the visual alarm indicator. This switch shall be overridden upon activation of a subsequent alarm. Provide trouble and supervisory silencing switch that shall silence the audible trouble and supervisory signal, but not extinguish the visual indicator. This switch shall be overridden upon activation of a subsequent trouble or supervisory signal. Audible trouble indication must resound automatically every 24 hours after the silencing feature has been operated.

##### 2.16.4 Non-Interfering

Power and supervise each circuit such that a signal from one device does

not prevent the receipt of signals from any other device. Circuits shall be manually resettable by switch from the remote control unit after the initiating device or devices have been restored to normal.

#### 2.16.5 Memory

Provide each control unit with non-volatile memory and logic for all functions. The use of long life batteries, capacitors, or other age-dependent devices shall not be considered as equal to non-volatile processors, PROMS, or EPROMS.

#### 2.16.6 Field Programmability

Provide control units that are fully field programmable for control, initiating, supervisory, and trouble functions of both input and output. The system program configuration shall be menu driven. System changes shall be password protected and shall be accomplished using personal computer based equipment.

#### 2.16.7 Input/Output Modifications

Each remote control unit shall contain features that allow the elimination of input devices from the system or the modification of system outputs. Any such modifications shall indicate a trouble condition on the remote control unit, the FACP, and a printed output of the trouble condition.

#### 2.16.8 Resetting

Provide the necessary controls to prevent the resetting of any alarm, supervisory, or trouble signal while the alarm, supervisory, or trouble condition on the system still exists.

#### 2.16.9 Instructions

Provide a typeset printed or typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the remote fire alarm control unit. The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, supervisory, and trouble. The instructions shall be approved by the Contracting Officer before being posted.

#### 2.16.10 Walk Test

Each remote control unit shall have a walk test feature. When using this feature, operation of initiating devices shall result in limited system outputs, so that the notification appliances operate for only a few seconds and the event is indicated on the system printer, but no other outputs occur.

#### 2.16.11 History Logging

In addition to the required printer output, the control panel shall have the ability to store a minimum of 4000 events in a log. These events shall be stored in a battery-protected memory and shall remain in the memory until the memory is downloaded or cleared manually. Resetting of the

control panel shall not clear the memory.

## 2.17 AMPLIFIERS, PREAMPLIFIERS, TONE GENERATORS

Any amplifiers, preamplifiers, tone generators, digitalized voice generators, and other hardware necessary for a complete, operational, textual audible circuit conforming to NFPA 72 shall be housed in a fire alarm control unit, terminal cabinet, or in the fire alarm control panel. The system shall automatically operate and control all building fire alarm horns.

### 2.17.1 Construction

Amplifiers shall utilize computer grade solid state components and shall be provided with output protection devices sufficient to protect the amplifier against any transient up to 10 times the highest rated voltage in the system.

### 2.17.2 Inputs

Each system shall be equipped with separate inputs from the tone generator.

### 2.17.3 Tone Generator

The tone generator shall be of the modular, plug-in type with securely attached labels to identify the component as a tone generator and to identify the specific tone it produces. The tone generator shall produce a slow whoop tone, that shall slowly ascend from low (500 hertz) to high (1200 hertz), and shall be constantly repeated until interrupted by either the digitalized voice message, the microphone input, or the alarm silence mode as specified. Each slow whoop cycle shall last approximately 4 seconds. The tone generator shall be single channel with an automatic backup generator per channel such that failure of the primary tone generator causes the backup generator to automatically take over the functions of the failed unit and also causes transfer of the common trouble relay.

### 2.17.4 Protection Circuits

Each amplifier shall be constantly supervised for any condition that could render the amplifier inoperable at its maximum output. Failure of any component shall cause automatic transfer to a designated backup amplifier, illumination of a visual "amplifier trouble" indicator on the control panel, appropriate logging of the condition on the system printer, and other actions for trouble conditions as specified.

## 2.22 MANUAL STATIONS

Provide metal or plastic, semi-flush mounted, dual action push pull type, addressable manual stations, that are not subject to operation by jarring or vibration. Stations shall be equipped with screw terminals for each conductor. Stations that require the replacement of any portion of the device after activation are not permitted. Stations shall be finished in fire-engine red with molded raised lettering operating instructions of contrasting color. The use of a key or wrench shall be required to reset the station. Manual stations shall be mounted at 48 to 54 inches. Stations shall have a separate screw terminal for each conductor.

## 2.23 NOTIFICATION APPLIANCES

### 2.23.6 Connections

Provide screw terminals for each notification appliance. Terminals shall be designed to accept the size conductors used in this project without modification.

## 2.24 ENVIRONMENTAL ENCLOSURES OR GUARDS

Environmental enclosures shall be provided to permit Fire Alarm or Mass Notification components to be used in areas that exceed the environmental limits of the listing. The enclosure shall be listed for the device or appliance as either a manufactured part number or as a listed compatible accessory for the UL category that the component is currently listed. Guards required to deter mechanical damage shall be either a listed manufactured part or a listed accessory for the category of the initiating device or notification appliance.

## 2.25 VALVE MONITOR SWITCHES (TAMPER SWITCHES)

Provide a tamper switch for each fire protection system control valve. Tamper switches shall be UL listed as "Extinguishing System Attachment" for the location and type of valve supervised. The device shall contain double pole, double throw contacts. Operation of the switch shall cause a supervisory signal to be transmitted to the FACP upon not more than two complete turns of the valve wheel or a closure of 10 percent, whichever is less. Tamper switches shall be equipped with screw terminals for each conductor.

## 2.26 WATERFLOW DETECTORS

a. Provide vane type waterflow detectors for wet pipe sprinkler systems. The device shall contain double pole, double throw contacts. Equip the detector with a pneumatic time delay, field adjustable from 0 to 90 seconds. The time delay shall be set initially to 45seconds. The device shall be a UL listed extinguishing system attachment rated for the particular pressure and location that it is installed. Flow switches shall be equipped with screw terminals for each conductor.

b. Provide pressure type waterflow detectors for dry pipe sprinkler systems, pre-action, and deluge systems. Switch shall be equipped with equipped to provide a time delay from 0 to 90 second. The device shall contain double pole, double throw contacts. The device shall be a UL listed extinguishing system attachment rated for the particular pressure and location that it is installed. Switch shall be equipped with screw terminals for each conductor.

## PART 3 EXECUTION

### 3.2 SYSTEM FIELD WIRING

#### 3.2.1 Wiring within Cabinets, Enclosures, and Boxes

Provide wiring installed in a neat and workmanlike manner and installed parallel with or at right angles to the sides and back of any box, enclosure, or cabinet. Conductors that are terminated, spliced, or

otherwise interrupted in any enclosure, cabinet, mounting, or junction box shall be connected to terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. Make connections with approved pressure type terminal blocks, that are securely mounted. The use of wire nuts or similar devices shall be prohibited. Wiring shall conform to NFPA 70.

### 3.2.2 Terminal Cabinets

Provide a terminal cabinet at the base of any circuit riser, on each floor at each riser, and where indicated on the drawings. Terminal size shall be appropriate for the size of the wiring to be connected. Conductor terminations shall be labeled and a drawing containing conductors, their labels, their circuits, and their interconnection shall be permanently mounted in the terminal cabinet. Minimum size is 8 inches by 8 inches.

### 3.2.3 Alarm Wiring

Provide all wiring in 3/4" minimum size rigid metal conduit or 3/4" minimum size intermediate metal conduit. Conduit shall be red. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Electrical metallic tubing conduit is acceptable in dry locations not enclosed in concrete or where not subject to mechanical damage. Conceal conduit in finished areas of new construction and wherever practicable in existing construction. The use of flexible conduit not exceeding a 6 foot length shall be permitted in initiating device circuits. Run conduit or tubing concealed unless specifically shown otherwise on the drawings. Shielded wiring shall be utilized where recommended by the manufacturer. For shielded wiring, the shield shall be grounded at only one point, that shall be in or adjacent to the FACP. Pigtail or T-tap connections to signal line circuits, initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. T-tapping using screw terminal blocks is allowed for Style 5 addressable systems. Color coding is required for circuits and shall be maintained throughout the circuit. Conductors used for the same functions shall be similarly color coded. Wiring shall conform to NFPA 70.

### 3.2.4 Conductor Terminations

Labeling of conductors at terminal blocks in terminal cabinets, FACP, and remote fire alarm control units shall be provided at each conductor connection. Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. Each terminal cabinet, FACP, and fire alarm control unit shall contain a laminated drawing that indicates each conductor, its label, circuit, and terminal. The laminated drawing shall be neat, using 12 point lettering minimum size, and mounted within each cabinet, panel, or unit so that it does not interfere with the wiring or terminals. Maintain existing color code scheme where connecting to existing equipment.

## 3.4 CONNECTION OF NEW SYSTEM

The following new system connections shall be made during the last phase of construction, at the beginning of the preliminary tests. New system connections shall include:

- a. Connection of new control modules to existing magnetically held smoke door (hold-open) devices.

- b. Connection of new system transmitter to existing base fire reporting system.

Once these connections are made, system shall be left energized and new audio/visual devices deactivated. Report immediately to the Contracting Officer, coordination and field problems resulting from the connection of the above components.

### 3.5 FIRESTOPPING

Provide firestopping for holes at conduit penetrations through floor slabs, fire rated walls, partitions with fire rated doors, corridor walls, and vertical service shafts in accordance with: NFPA 70, NFPA 101, NFPA 221, & NFPA 251.

### 3.6 PAINTING

Paint junction boxes conduit and surface metal raceways red.

### 3.7 FIELD QUALITY CONTROL

#### 3.7.1 Testing Procedures

Detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 4 Fire Alarm Technician, and signed by representative of the installing company, for the fire detection and alarm system 60 days prior to performing system tests. Detailed test procedures shall list all components of the installed system such as initiating devices and circuits, notification appliances and circuits, signaling line devices and circuits, control devices/equipment, batteries, transmitting and receiving equipment, power sources/supply, annunciators, special hazard equipment, emergency communication equipment, interface equipment, Guard's Tour equipment, and transient (surge) suppressors. Test procedures shall include sequence of testing, time estimate for each test, and sample test data forms. The test data forms shall be in a check-off format (pass/fail with space to add applicable test data) and shall be used for the preliminary testing and the acceptance testing. The test data forms shall record the test results and shall:

- a. Identify the NFPA Class and Style of all Initiating Device Circuits (IDC), Notification Appliance Circuits (NAC), Voice Notification System, and Signaling Line Circuits (SLC).
- b. Identify each test required by NFPA 72 Test Methods and required test herein to be performed on each component, and describe how this test shall be performed.
- c. Identify each component and circuit as to type, location within the facility, and unique identity within the installed system. Provide necessary floor plan sheets showing each component location, test location, and alphanumeric identity.
- d. Identify all test equipment and personnel required to perform each test (including equipment necessary for testing smoke detectors using real smoke).
- e. Provide space to identify the date and time of each test. Provide

space to identify the names and signatures of the individuals conducting and witnessing each test.

### 3.7.2 Tests Stages

a. Preliminary Testing (Contractor Test): Conduct preliminary tests to ensure that devices and circuits are functioning properly. Tests shall meet the requirements of paragraph entitled "Minimum System Tests." After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that panel functions were tested and operated properly. The letter shall include the names and titles of the witnesses to the preliminary tests. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.

b. Request for Formal Inspection and Tests: When tests have been completed and corrections made, submit a signed, dated certificate with a request for formal inspection.

c. Final Testing: Notify the Contracting Officer in writing when the system is ready for final acceptance testing. Submit request for test at least 72 hours prior to the test date. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. Furnish instruments and personnel required for the tests. A final acceptance test will not be scheduled until the operation and maintenance (O&M) manuals are furnished to the Contracting Officer and the following are provided at the job site:

- (1) The systems manufacturer's technical representative
- (2) Marked-up red line drawings of the system as actually installed
- (3) Megger test results
- (4) Loop resistance test results
- (5) Complete program printout including input/output addresses

The final tests shall be witnessed by the Contracting Officer and AHJ or SH Sr. Fire Protection Specialists. At this time, any and all required tests shall be repeated at their discretion. Following acceptance of the system, as-built drawings and O&M manuals shall be delivered to the Contracting Officer for review and acceptance.

### 3.7.3 Minimum System Tests

Test the system in accordance with the procedures outlined in NFPA 72, ISO 7240-16, IEC 60268-16. The required tests are as follows:

a. Megger Tests: After wiring has been installed, and prior to making any connections to panels or devices, wiring shall be megger tested for insulation resistance, grounds, and/or shorts. Conductors with 300 volt rated insulation shall be tested at a minimum of 250 VDC. Conductors

with 600 volt rated insulation shall be tested at a minimum of 500 VDC. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.

- b. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.
- c. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final system test.
- d. Verify that the control unit is in the normal condition as detailed in the manufacturer's O&M manual.
- e. Test each initiating and indicating device and circuit for proper operation and response at the control unit. Smoke sensors shall be tested in accordance with manufacturer's recommended calibrated test method. Use of magnets is prohibited. Testing of duct smoke detectors shall comply with the requirements of NFPA 72.
- f. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer's O&M manual.
- g. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the time period and in the manner specified.
- h. Determine that the system is operable under trouble conditions as specified.
- i. Visually inspect wiring.
- j. Test the battery charger and batteries.
- k. Verify that software control and data files have been entered or programmed into the FACP. Hard copy records of the software shall be provided to the Contracting Officer.
- l. Verify that red-line drawings are accurate.
- m. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.
- n. Measure voltage readings for circuits to ensure that voltage drop is not excessive.
- o. Disconnect the verification feature for smoke sensors during tests to minimize the amount of smoke needed to activate the sensor. Testing of smoke sensors shall be conducted using real smoke. The use of canned smoke is prohibited.
- p. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.

q. Opening the circuit at not less than all of alarm initiating devices and notification appliances to test the wiring supervisory feature.

r. Demonstrate modem communications with remote sites as specified by the COTR. Dial in capability shall also, be demonstrated, using specified security.

s. Demonstrate fiber optic communications with remote sites as specified by the COR. Dial in capability shall also, be demonstrated, using specified security.

t. Perform 10% site wide testing in conformance with NFPA 72.

### 3.8 INSTRUCTION OF GOVERNMENT EMPLOYEES

#### 3.8.1 Instructor

Include in the project the services of an instructor, who has received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided. The instructor shall train the Government employees designated by the Contracting Officer, in the care, adjustment, maintenance, and operation of the fire alarm and fire detection system. Each instructor shall be thoroughly familiar with all parts of this installation. The instructor shall be trained in operating theory as well as in practical O&M work.

#### 3.8.2 Required Instruction Time

Provide 8 hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer. The training shall allow for rescheduling for unforeseen maintenance and/or fire department responses.

#### 3.8.3 Technical Data and Computer Software

Provide, in manual format, lesson plans, operating instructions, maintenance procedures, and training data for the training courses. The operations training shall familiarize designated government personnel with proper operation of the installed system. The maintenance training course shall provide the designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system.

-- End of Section --

SECTION 31 23 00.00 20

EXCAVATION AND FILL

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 in the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600 (2005) Installation of Ductile-Iron Water Mains and Their Appurtenances

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z535.1 (2006) Standard for Safety Color Code

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2008) Structural Welding Code - Steel

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C2 (2003) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes

AWPA P5 (2005) Standard for Waterborne Preservatives

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z535.1 (2006) Standard for Safety Color Code

ASTM INTERNATIONAL (ASTM)

ASTM A 139 (2000) Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over)

ASTM A 252 (1998; R 2002) Welded and Seamless Steel Pipe Piles

ASTM C 136 (2005) Sieve Analysis of Fine and Coarse Aggregates

ASTM C 33 (2003) Standard Specification for Concrete Aggregates

ASTM D 1140 (2000) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve

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ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2007) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft <sup>3</sup> ) (2,700 kN-m/m <sup>3</sup> )
ASTM D 1883	(1999) CBR (California Bearing Ratio) of Laboratory-Compacted Soils
ASTM D 2216	(2005) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 2321	(2005) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2434	(1968; R 2000) Permeability of Granular Soils (Constant Head)
ASTM D 2487	(2000e1) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(2004) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(2004) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3786	(2001) Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method
ASTM D 422	(1963; R 2002) Particle-Size Analysis of Soils
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 4355	(2002) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D 4491	(1999; R 2004) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(2004) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991; R 2003) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(2004) Determining Apparent Opening Size of a Geotextile
ASTM D 4759	(2002) Determining the Specification

Conformance of Geosynthetics

ASTM D 4829	(2003) Expansion Index of Soils
ASTM D 4833	(2000e1) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 698	(2000ae1) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION (CDT)

SS-1	(2006 Edition) Standard Specifications
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U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2008; Change 1-2010; Change 3-2010; Errata 1-2010) Safety and Health Requirements Manual
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U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 530/F-93/004	(1993; Rev O; Updates I, II, IIA, IIB, and III) Test Methods for Evaluating Solid Waste (Vol IA, IB, IC, and II) (SW-846)
EPA 600/4-79/020	(1983) Methods for Chemical Analysis of Water and Wastes

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1909	(Basic Notice 1; Canc. Notice 2) Fertilizer
FS A-A-203	(Rev C; Notice 2) Paper, Kraft, Untreated

1.2 DEFINITIONS

1.2.1 Capillary Water Barrier

A layer of clean, poorly graded crushed rock, stone, or natural sand or gravel having a high porosity which is placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below a slab.

1.2.2 Degree of Compaction

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, for general soil types, abbreviated as percent laboratory maximum density.

1.2.3 Hard Materials

Weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" but which usually

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require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.2.4 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding 1/2 cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.2.5 Pile Supported Structure

As used herein, a structure where both the foundation and floor slab are pile supported.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Shoring and Sheeting Plan; G  
Dewatering work plan; G  
BASE COURSE AGGREGATES; G

Submit 15 days prior to starting work.

SD-06 Test Reports

Fill and backfill test  
Density tests  
Moisture Content Tests

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

1.4 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

1.5 CRITERIA FOR BIDDING

Base bids on the following criteria:

- a. Surface elevations are as indicated.
- b. Pipes or other artificial obstructions, except those indicated, will not be encountered.

- c. Ground water will not be encountered.
- d. PPE and vapor monitoring will be required as determined by the Dryden Safety, Health and Environmental Office.
- e. Borrow material in the quantities required is not available on the project site at the location indicated.
- f. Blasting will not be permitted. Remove material in an approved manner.
- g. Ground penetrating radar and pot-holing shall be required to locate existing utilities. A map of existing utilities will be provided to the Contractor.
- h. The soils are firm, dry, silty, granitic sand from alluvial deposits laid over fractured granite bedrock. They are classified as "Type C" in accordance with OSHA soil classification - 1926 Subpart P, Appendix A. The scope of excavation work in this contract will include 20% of rock and/or hard material excavation.

#### 1.6 REQUIREMENTS FOR OFF SITE SOIL

Soils brought in from off site for use as backfill shall be tested for TPH, BTEX and full TCLP including ignitability, corrosivity and reactivity. Backfill shall contain less than 100 parts per million (ppm) of total petroleum hydrocarbons (TPH) and less than 10 ppm of the sum of Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and shall not fail the TCPL test. TPH concentrations shall be determined by using EPA 600/4-79/020 Method 418.1. BTEX concentrations shall be determined by using EPA 530/F-93/004 Method 5030/8020. TCLP shall be performed in accordance with EPA 530/F-93/004 Method 1311. Material shall not be brought on site until tests have been approved by the Contracting Officer.

#### 1.7 QUALITY ASSURANCE

##### 1.7.1 Shoring and Sheet piling Plan

Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheet piling of excavations. Drawings shall include material sizes and types, arrangement of members, and the sequence and method of installation and removal. Calculations shall include data and references used.

##### 1.7.2 Dewatering Work Plan

Submit procedures for accomplishing dewatering work.

##### 1.7.3 Utilities

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. Excavation made with power-driven equipment is not permitted within two feet of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or

until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

## PART 2 PRODUCTS

### 2.1 SOIL MATERIALS

#### 2.1.1 Satisfactory Materials

Any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, and deleterious, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.

#### 2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 3 inches. The Contracting Officer shall be notified of any contaminated materials.

#### 2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM, GP-GM, GW-GM, SW-SM, SP-SM, and SM shall be identified as cohesionless only when the fines are nonplastic (plasticity index equals zero). Materials classified as GM and SM will be identified as cohesive only when the fines have a plasticity index greater than zero.

#### 2.1.4 Expansive Soils

Soils that have an expansion index (EI) equal to or greater than 20 when tested in accordance with ASTM D 4829.

#### 2.1.5 Common Fill

Approved, unclassified soil material with the characteristics required to compact to the soil density specified for the intended location.

#### 2.1.6 Backfill and Fill Material

ASTM D 2487, classification GW, GP, GM, SW, SP, SM, with a maximum ASTM D 4318 liquid limit of 35, maximum ASTM D 4318 plasticity index of 12, and a maximum of 25 percent by weight passing ASTM D 1140, No. 200 sieve.

### 2.2 UTILITY BEDDING MATERIAL

Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as

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specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D 1557 maximum density. Plastic piping shall have bedding to 12 inches above top of pipe. Provide ASTM D 2321 materials as follows:

- a. Class I: Angular, 0.25 to 1.5 inches, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.
- b. Class II: Coarse sands and gravels with maximum particle size of 1.5 inches, including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D 2487.

2.2.1 Sand

Clean, coarse-grained sand classified as SW or SP by ASTM D 2487 for bedding and backfill as indicated.

2.2.2 Gravel

Clean, coarsely graded natural gravel, crushed stone or a combination thereof having a classification of GW or GP in accordance with ASTM D 2487 for bedding and backfill as indicated. Maximum particle size shall not exceed 3 inches.

2.3 BASE COURSE AGGREGATES

Imported base course: Section 26 of SS-1, Class 2, for 3/4 inch maximum size gradation.

2.4 BORROW

Obtain borrow materials required in excess of those furnished from excavations from sources outside of Government property. Dispose of materials from clearing and grubbing operations off Government property.

2.5 BURIED WARNING AND IDENTIFICATION TAPE

Polyethylene plastic or metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 6 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil, and shall conform to ANSI Z535.1 with colors as used by APWA as listed below:

Warning Tape Color Codes

Red:	Electric Power & Lighting Circuits
Yellow:	Gas, Oil, Steam, or Gaseous Materials
Orange:	Communications, Signal Lines, Telephone, Fiber Optic, and Data
Blue:	Potable Water Systems

Warning Tape Color Codes

Green:	Sanitary Sewer and Drain Systems
Purple:	Reclaimed Water and Slurry Systems
Grey:	Compressed Air

2.5.1 Warning Tape for Metallic Piping

Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

2.5.2 Detectable Warning Tape for Non-Metallic Piping

Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

2.6 DETECTION WIRE FOR NON-METALLIC PIPING

Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Shoring and Sheeting

Provide shoring, bracing, sheeting where indicated. In addition to Section 25 A and B of EM 385-1-1 and other requirements set forth in this contract, include provisions in the shoring and sheeting plan that will accomplish the following:

- a. Prevent undermining of pavements, foundations and slabs.
- b. Prevent slippage or movement in banks or slopes adjacent to the excavation.
- c. Allow for the abandonment of shoring and sheeting materials in place in critical areas as the work is completed. In these areas, backfill the excavation to the elevation indicated and remove the remaining exposed portion of the shoring before completing the backfill.

3.1.2 Drainage and Dewatering

Provide for the collection and disposal of surface and subsurface water encountered during construction.

3.1.2.1 Drainage

So that construction operations progress successfully, completely drain construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish/construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction. Grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, dikes, swales, and other drainage features and equipment as required to maintain dry soils, prevent erosion and undermining of foundations. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

#### 3.1.2.2 Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least 3 feet below the working level.

#### 3.1.3 Underground Utilities

Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction. The Contractor shall scan the construction site with electromagnetic and sonic equipment and mark the surface of the ground where existing underground utilities are discovered.

#### 3.1.4 Machinery and Equipment

Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

### 3.2 SURFACE PREPARATION

#### 3.2.1 Clearing and Grubbing

Unless indicated otherwise, remove trees, stumps, logs, shrubs, brush and vegetation and other items that would interfere with construction operations within the indicated project limits. Remove stumps entirely. Grub out matted roots and roots over 2 inches in diameter to at least 18 inches below existing surface.

### 3.2.2 Unsuitable Material

Remove vegetation, debris, decayed vegetable matter, sod, mulch, and rubbish underneath paved areas or concrete slabs.

### 3.3 EXCAVATION

Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. Keep excavations free from water. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed. Refill with backfill and fill material and compact to 95 percent of ASTM D 1557 maximum density. Unless specified otherwise, refill excavations cut below indicated depth with backfill and fill material and compact to 95 percent of ASTM D 1557 maximum density. Satisfactory material removed below the depths indicated, without specific direction of the Contracting Officer, shall be replaced with satisfactory materials to the indicated excavation grade; except as specified for spread footings. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

#### 3.3.1 Structures With Spread Footings

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Fill over excavations with concrete during foundation placement.

#### 3.3.2 Pipe Trenches

Excavate to the dimension indicated. Grade bottom of trenches to provide uniform support for each section of pipe after pipe bedding placement. Tamp if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length.

#### 3.3.5 Excavated Materials

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Paragraph "DISPOSITION OF SURPLUS MATERIAL."

### 3.4 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a

minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Minimum subgrade density shall be as specified herein.

### 356 FILLING AND BACKFILLING

Fill and backfill to contours, elevations, and dimensions indicated. Compact each lift before placing overlaying lift.

#### 3.5.1 Common Fill Placement

Provide for general site. Place in 6 inch lifts. Compact areas not accessible to rollers or compactors with mechanical hand tampers. Aerate material excessively moistened by rain to a satisfactory moisture content. Finish to a smooth surface by blading, rolling with a smooth roller, or both.

#### 3.5.2 Backfill and Fill Material Placement

Provide for paved areas and under concrete slabs, except where select material is provided. Place in 6 inch lifts. Do not place over wet or frozen areas. Place backfill material adjacent to structures as the structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against the structure.

#### 3.5.3 Backfill and Fill Material Placement Over Pipes and at Walls

Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 2 feet above sewer lines and 1 foot above other utility lines shall be free from stones larger than 1 inch in any dimension. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 4 inches in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes to avoid damage to coatings or wrappings. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall.

#### 3.5.4 Trench Backfilling

Backfill as rapidly as construction, testing, and acceptance of work permits. Place and compact backfill under structures and paved areas in 6 inch lifts to top of trench and in 6 inch lifts to one foot over pipe

outside structures and paved areas.

### 3.6 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved borrow materials shall be obtained as specified herein.

### 3.7 BURIED WARNING AND IDENTIFICATION TAPE

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

### 3.8 BURIED DETECTION WIRE

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

### 3.9 COMPACTION

Determine in-place density of existing subgrade; if required density exists, no compaction of existing subgrade will be required. Density requirements specified herein are for cohesionless materials. When cohesive materials are encountered or used, density requirements may be reduced by 5 percent.

#### 3.9.1 General Site

Compact underneath areas designated for vegetation and areas outside the 5 foot line of the paved area or structure to 85 percent of ASTM D 1557. Compact expansive materials to not less than 85 percent nor more than 90 percent.

#### 3.9.2 Structures, Spread Footings, and Concrete Slabs

Compact top 12 inches of subgrades to 95 percent of ASTM D 1557. Compact fill and backfill material to 95 percent of ASTM D 1557.

#### 3.9.3 Adjacent Area

Compact areas within 5 feet of structures to 90 percent of ASTM D 1557.

#### 3.9.4 Paved Areas

Compact top 12 inches of subgrades to 95 percent of ASTM D 1557. Compact fill and backfill materials to 95 percent of ASTM D 1557.

### 3.10 FINISH OPERATIONS

### 3.10.1 Grading

Finish grades as indicated within one-tenth of one foot. Grade areas to drain water away from structures. Maintain areas free of trash and debris. For existing grades that will remain but which were disturbed by Contractor's operations, grade as directed.

### 3.11 DISPOSITION OF SURPLUS MATERIAL

Remove from Government property surplus or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber.

### 3.12 FIELD QUALITY CONTROL

#### 3.12.1 Sampling

Take the number and size of samples required to perform the following tests.

#### 3.12.2 Testing

Perform one of each of the following tests for each material used. Provide additional tests for each source change.

##### 3.12.2.1 Fill and Backfill Material Testing

Test fill and backfill material in accordance with ASTM C 136 for conformance to ASTM D 2487 gradation limits; ASTM D 1140 for material finer than the No. 200 sieve; ASTM D 4318 for liquid limit and for plastic limit; ASTM D 1557 for moisture density relations, as applicable.

##### 3.12.2.2 Density Tests

Test density in accordance with ASTM D 1556, or ASTM D 2922 and ASTM D 3017. When ASTM D 2922 and ASTM D 3017 density tests are used, verify density test results by performing an ASTM D 1556 density test at a location already ASTM D 2922 and ASTM D 3017 tested as specified herein. Perform an ASTM D 1556 density test at the start of the job, and for every 10 ASTM D 2922 and ASTM D 3017 density tests thereafter. Test each lift at randomly selected locations every 2000 square feet of existing grade in fills for structures and concrete slabs, and every 2500 square feet for other fill areas and every 2000 square feet of subgrade in cut. Include density test results in daily report.

- a. Bedding and backfill in trenches: One test per 50 linear feet in each lift.

##### 3.12.2.3 Moisture Content Tests

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D 2216. Include moisture content test results in daily report.

-- End of Section --

SECTION 33 11 00

WATER DISTRIBUTION  
10/06

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 NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B18.5.2.1M (1981; R 1995) Metric Round Head Short Square Neck Bolts

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-05 (2006; Errata 2007) Minimum Design Loads for Buildings and Other Structures

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104 (2008) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

AWWA C105 (2008) Polyethylene Encasement for Ductile-Iron Pipe Systems

AWWA C110 (2008) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1219 mm), for Water

AWWA C111 (2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

AWWA C115/A21.15 (2005) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges

AWWA C151 (2002; Errata 2002) Ductile-Iron Pipe, Centrifugally Cast, for Water

AWWA C153 (2006) Ductile-Iron Compact Fittings for Water Service

AWWA C200 (2005) Steel Water Pipe - 6 In. (150 mm) and Larger

AWWA C206 (2003) Field Welding of Steel Water Pipe

AWWA C207 (2007) Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)

AWWA C208 (2007) Dimensions for Fabricated Steel Water Pipe Fittings

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AWWA C210	(2007) Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
AWWA C213	(2007) Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
AWWA C500	(2002; R 2003) Metal-Seated Gate Valves for Water Supply Service
AWWA C503	(2005) Wet-Barrel Fire Hydrants
AWWA C504	(2006) Standard for Rubber-Seated Butterfly Valves
AWWA C508	(2001) Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS
AWWA C509	(2001) Resilient-Seated Gate Valves for Water Supply Service
AWWA C511	(2007) Standard for Reduced-Pressure Principle Backflow Prevention Assembly
AWWA C600	(2005) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C605	(2005) Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
AWWA C606	(2006) Grooved and Shouldered Joints
AWWA C651	(2005; Errata 2005) Standard for Disinfecting Water Mains
AWWA C701	(2007) Cold-Water Meters - Turbine Type, for Customer Service
AWWA C707	(2005) Encoder-Type Remote-Registration Systems for Cold-Water Meters
AWWA C900	(2007; Errata 2008) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution
AWWA C905	(1997) Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings 14 In. Through 48 In. (350 mm through 1,200 mm)
AWWA C909	(2002) Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 IN through 12 IN (100 mm Through 300 mm), for Water Distribution

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- AWWA D103 (1997) Factory-Coated Bolted Steel Tanks for Water Storage
- AWWA M11 (2004) Manual: Steel Pipe: A Guide for Design and Installation
- AWWA M23 (2002) Manual: PVC Pipe - Design and Installation

ASME INTERNATIONAL (ASME)

- ASME B16.1 (2005) Standard for Gray Iron Threaded Fittings; Classes 125 and 250
- ASME B16.15 (2006) Cast Bronze Threaded Fittings Classes 125 and 250
- ASME B18.2.2 (1987; R 2005) Standard for Square and Hex Nuts (Inch Series)
- ASME B18.5.2.2M (1982; R 2005) Metric Round Head Square Neck Bolts

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

- ASSE 1060 (1996) Performance Requirements for Outdoor Enclosures for Backflow Prevention Assemblies

ASTM INTERNATIONAL (ASTM)

- ASTM A 307 (2007b) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
- ASTM A 47/A 47M (2004) Standard Specification for Ferritic Malleable Iron Castings
- ASTM A 48/A 48M (2003; R 2008) Standard Specification for Gray Iron Castings
- ASTM A 536 (1984; R 2009) Standard Specification for Ductile Iron Castings
- ASTM A 563 (2007a) Standard Specifications for Carbon and Alloy Steel Nuts
- ASTM A 98 (1992) Spiegeleisen
- ASTM B 32 (2008) Standard Specification for Solder Metal
- ASTM B 42 (2002e1) Standard Specification for Seamless Copper Pipe, Standard Sizes
- ASTM C 94/C 94M (2009) Standard Specification for Ready-Mixed Concrete
- ASTM D 1784 (2008) Rigid Poly(Vinyl Chloride) (PVC)

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	Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(2005) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(2006) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(2004e1) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2774	(2008) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	(1996; R 2002) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3139	(1998; R 2005) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM F 1483	(2005) Oriented Poly(Vinyl Chloride), PVC-O, Pressure Pipe
ASTM F 402	(2005) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 477	(2008) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH  
(FCCCHR)

FCCCHR List (continuously updated) List of Approved Backflow Prevention Assemblies

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS  
INDUSTRY (MSS)

MSS SP-80 (2008) Bronze Gate, Globe, Angle and Check

Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24	(2010) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 325-1	(1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
NFPA 49	(2003) Hazardous Chemicals Data
NFPA 704	(2006) Identification of the Hazards of Materials for Emergency Response

NSF INTERNATIONAL (NSF)

NSF 61	(2008) Drinking Water System Components - Health Effects
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THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 10	(2007) Near-White Blast Cleaning
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UNDERWRITERS LABORATORIES (UL)

UL 246	(1993; Rev thru Dec 1998) Hydrants for Fire-Protection Service
UL 312	(2004; Rev thru Jun 2009) Check Valves for Fire-Protection Service
UL 789	(2004; Rev thru Aug 2008) Indicator Posts for Fire-Protection Service

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3	(1992) Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe (Nominal Diameters 4-36 Inch)
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1.2 DESIGN REQUIREMENTS

1.2.1 Water Distribution Mains

Provide water distribution mains indicated as 4 through 20 inch diameter pipe sizes of ductile-iron, molecularly oriented polyvinyl chloride pressure (PVCO), or polyvinyl chloride (PVC) plastic pipe, as indicated. Provide water main accessories, gate valves, check valves, and backflow preventers as specified and where indicated.

1.2.2 Water Service Lines

Provide water service lines indicated as less than 4 inch and smaller lines from water distribution main to building service at the points indicated. Water service lines shall be copper pipe or polyvinyl chloride (PVC) plastic pipe, as indicated. Provide water service line appurtenances as specified and where indicated.

### 1.2.3 New Bolted Steel Reservoir Tank Design Standards

#### 1.2.3.1 Design and Construction Standards

The design, fabrication, and erection of the reservoir shall be in accordance with the applicable requirements of AWWA D103 except as modified herein. Earthquake design shall be in accordance with UFC 3-310-04 SEISMIC DESIGN FOR BUILDINGS and ASCE 7-05 and as indicated. No additional thickness for corrosion allowance will be required. Design metal temperature shall be 130 degrees F. The reservoir shall be designed for a peak wind speed of 90 mph and no snow load.

#### 1.2.3.2 Welding

Welding on the tank is not allowed. The tank shall have all bolted construction.

#### 1.2.3.3 Reservoir

The reservoir shall have a storage capacity of not less than 50,000 gallons. The high-water level of reservoir shall be at elevation 2290 feet with the top of foundation approximately at elevation 2280 feet, as indicated. The range between high and low water levels will be approximately 10 feet. Existing grade at proposed location is approximately elevation 2280 feet. The reservoir shall have such standard shell height and such diameter as will meet the requirements for the selected standard capacity and for the high-water level specified above. The reservoir may have a supported cone roof or a self-supporting umbrella roof or an aluminum self-supporting dome roof as approved. The reservoir shall be of all bolted construction.

#### 1.2.3.4 Sizing of Reservoir

Section 6 of AWWA D103.

#### 1.2.3.5 Coating System

All tank component surfaces shall be factory cleaned, rinsed, oven-dried, and abrasive-blasted to SSPC SP 10 (near white blast cleaning) to a 2 - 3 mil profile prior to coating. Coating materials for interior applications and all other materials which will be in normal contact with potable water shall conform to NSF 61. All parts must be coated within 15 minutes after blasting. Interior coating system (including underside of steel bottom, if used), first coat shall be a primer coat of thermoset epoxy applied to 2.5 mils average dry-film thickness, second coat to be thermoset epoxy applied to 2.5 mils average dry-film thickness - total interior coating to have total 5.0 mils average dry-film thickness. Exterior coating system, one coat of zinc-rich primer to 2.5 mils average dry-film thickness, two coats of thermoset epoxy applied to an average dry-film thickness of 2.5 mils per coat, topcoat (color coat) shall be urethane applied to an average dry-film thickness of 1.5 mils - exterior coating system to have 8.5 mils total average dry-film thickness. Final exterior color to be match that existing Tank NB114.

#### 1.2.3.6 Tank Erection

Field erection of the factory coated bolted steel tank shall be in strict accordance with the tank manufacturer's design and recommendations and shall be accomplished by a factory-trained and certified erection crew.

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Particular care shall be exercised in handling and bolting tank plates, supports and members to avoid abrasion and scratching of the coating system. Touch-up coating shall be done in accordance with the tank manufacturer's recommendations and procedures. Tank segment gaskets shall be Buna-N synthetic rubber, while bolts shall be encapsulated to provide corrosion resistance at all seam, joints, and connections.

1.2.3.7 Testing

Following completion of erection and cleaning of the tank, the tank shall be tested for liquid-tightness by filling the tank to its indicated overflow elevation. Any leaks disclosed by the tank test shall be corrected by the tank erection crew in accordance with the tank manufacturer's recommendations. The leak test/correction procedure shall be repeated until satisfactory results are achieved.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Piping Materials

Water distribution main piping, fittings, joints, valves, and coupling; G

Water service line piping, fittings, joints, valves, and coupling; G

Reduced pressure principle backflow preventer assemblies; G

Valve boxes; G

Service saddle; G

Tapping sleeves; G

Insulation; G

Bolted Steel Reservoir Tank

Relining Product Data; G

Submit manufacturer's standard drawings or catalog cuts. Include information concerning gaskets with submittal for joints and couplings.

SD-06 Test Reports

Bacteriological Disinfection; G

Test results from commercial laboratory verifying disinfection

SD-07 Certificates

Water distribution main piping, fittings, joints, valves, and coupling

Water service line piping, fittings, joints, valves, and coupling

Reduced pressure principle backflow preventer assemblies

Certificates shall attest that tests set forth in each applicable referenced publication have been performed, whether specified in that publication to be mandatory or otherwise and that production control tests have been performed at the intervals or frequency specified in the publication. Other tests shall have been performed within 3 years of the date of submittal of certificates

on the same type, class, grade, and size of material as is being provided for the project.

SD-08 Manufacturer's Instructions

Delivery, storage, and handling  
Installation procedures for water piping

SD-11 Closeout Submittals

GIS Record Of Survey Data

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping, jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves and backflow preventers free of dirt and debris.

1.4.2 Handling

Handle pipe, fittings, valves, backflow preventers, and other accessories in a manner to ensure delivery to the water pipeline in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place any other material or pipe inside a pipe or fitting after the coating has been applied. Carry, do not drag pipe to the pipeline or trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Store rubber gaskets that are not to be installed immediately, under cover out of direct sunlight.

1.4.2.1 Miscellaneous Plastic Pipe and Fittings

Handle Polyvinyl Chloride (PVC) pipe and fittings in accordance with the manufacturer's recommendations. Store plastic piping and jointing materials that are not to be installed immediately under cover out of direct sunlight.

Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325-1.

1.5 GIS Record Of Survey Data

MCAGCC has recently begun to implement a real property inventory and control system utilizing a Global Positioning System (GPS) survey of the station as the foundation of the property database. To accommodate, and to add to, the Geographic Information System (GIS) database that is based on the GPS survey, the Contractor shall locate and record the following data for the new water system improvements: valve size and type; date of installation; number of turns to open; depth and horizontal location; depth

and horizontal location of each bend or change in direction the water lines; horizontal location of each fire hydrant, underground hydrant control valve, and hydrant post indicator valve; and, size, depth, and horizontal location of each service connection to (new or existing) water mains. The location and related GPS survey reference data for several of the GPS survey benchmarks surrounding the project area(s) are indicated for reference. The electronic method of surveying utilizing the GPS method with the indicated benchmark data shall be utilized for collection of the specified water system GPS survey data. Horizontal and vertical positions shall be measured and recorded with an accuracy of plus/minus 0.25 feet (3 inches). All collected GPS survey data shall be compiled and submitted to the Contracting Officer weekly as the job progresses.

## PART 2 PRODUCTS

### 2.1 WATER DISTRIBUTION MAIN MATERIALS

#### 2.1.1 Piping Materials

##### 2.1.1.1 Ductile-Iron Piping

- a. Pipe and Fittings: Pipe, except flanged pipe, AWWA C151, Thickness Class 52. Flanged pipe, AWWA C115/A21.15. Fittings, AWWA C110 or AWWA C153; fittings with push-on joint ends conforming to the same requirements as fittings with mechanical-joint ends, except that the bell design shall be modified, as approved, for push-on joint. Fittings shall have pressure rating at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the specified joints. Pipe and fittings shall have cement-mortar lining, AWWA C104, standard thickness.
- b. Joints and Jointing Material:
  - (1) Joints: Joints for pipe and fittings shall be push-on joints or mechanical joints unless otherwise indicated. Provide flanged joints where indicated. Provide mechanically coupled type joints using a sleeve-type mechanical coupling where indicated. Provide grooved type joints where indicated. Provide insulating joints where indicated or specified. Joints made with sleeve-type mechanical coupling may be used in lieu of push-on joint, subject to the limitations specified in paragraph entitled "Sleeve-Type Mechanical Couplings." Grooved type joints may be used in lieu of flanged joint or push-on joint, except where joint is buried.
  - (2) Push-On Joints: Shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly, AWWA C111.
  - (3) Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets, AWWA C111.
  - (4) Flanged Joints: Bolts, nuts, and gaskets for flanged connections as recommended in the Appendix to AWWA C115/A21.15. Flange for setscrewed flanges shall be of ductile iron, ASTM A 536, Grade 65-45-12, and conform to the applicable requirements of ASME B16.1, Class 250. Setscrews for setscrewed flanges shall be 190,000 psi tensile strength, heat treated and zinc-coated steel. Gasket and lubricants for setscrewed flanges, in accordance with applicable requirements for mechanical-joint gaskets specified in AWWA C111. Design of setscrewed gasket shall provide for

confinement and compression of gasket when joint to adjoining flange is made.

(5) Insulating Joints: Designed to effectively prevent metal-to-metal contact at the joint between adjacent sections of piping. Joint shall be of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers. Gasket shall be of the dielectric type, full face, and in other respects as recommended in the Appendix to AWWA C115/A21.15. Bolts and nuts, as recommended in the Appendix to AWWA C115/A21.15.

(6) Sleeve-Type Mechanical Coupled Joints: As specified in paragraph entitled "Sleeve-Type Mechanical Couplings."

(7) Grooved Type Joints: Grooved pipe ends and couplings, AWWA C606. Joint dimension shall be as specified in AWWA C606 for rigid joints.

#### 2.1.1.2 Polyvinyl Chloride (PVC) Plastic Piping

- a. Pipe and Fittings: Pipe, 4 inch through 12 inch, AWWA C900, shall be plain end or gasket bell end, Pressure Class 200 (DR 14) with cast-iron-pipe-equivalent OD. Molecularly Oriented Polyvinyl Chloride (PVC) pressure pipe, AWWA C909, shall be plain end or gasket bell end, Pressure Class 200 with cast-iron-pipe-equivalent outside diameter.
- b. Pipe 14 through 36 diameter: AWWA C905 Pressure Class 200.
- c. Fittings for PVC pipe: Fittings shall be gray iron or ductile iron, AWWA C110 or AWWA C153, and have cement-mortar lining, AWWA C104, standard thickness. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except that bell design shall be modified, as approved, for push-on joint suitable for use with PVC plastic pipe specified in this paragraph. Iron fittings and specials shall be cement-mortar lined in accordance with AWWA C104. Fittings and specials may be of the same material as the pipe with elastomeric gaskets, all in conformance with AWWA C605 and AWWA C900. Pipe, couplings and fittings for PVC plastic pipe shall be manufactured of material conforming to ASTM F 1483 and ASTM D 1784, Class 12454-B. Schedule 80 PVC fittings shall conform to ASTM D 2467.
- d. Joints and Jointing Material: Joints for pipe shall be push-on joints, ASTM D 3139. Joints between pipe and metal fittings, valves, and other accessories shall be push-on joints ASTM D 3139, or compression-type joints/mechanical joints, ASTM D 3139 and AWWA C111. Provide each joint connection with an elastomeric gasket suitable for the bell or coupling with which it is to be used. Gaskets for push-on joints for pipe, ASTM F 477. Gaskets for push-on joints and compression-type joints/mechanical joints for joint connections between pipe and metal fittings, valves, and other accessories, AWWA C111, respectively, for push-on joints and mechanical joints. Mechanically coupled joints using a sleeve-type mechanical coupling, as specified in paragraph entitled "Sleeve-Type Mechanical Couplings," may be used as an optional jointing method in lieu of push-on joints on plain-end PVC plastic pipe, subject to the limitations specified for mechanically coupled joints using a sleeve-type mechanical coupling and to the

use of internal stiffeners as specified for compression-type joints in ASTM D 3139.

2.1.1.3 Steel Piping Spools

- a. Pipe and Fittings: Pipe, AWWA C200. Fittings, AWWA C208 and to AWWA C200, with reference to the requirements specified therein for "Special Sections." Pipe and fittings for aboveground lines shall have epoxy lining, conforming to AWWA C210 or AWWA C213, standard thickness. Ends of pipe and fittings shall be suitable for the joints and jointing materials used.
  - 1. Pipe shall be welded or seamless with plain or shouldered and grooved ends in accordance with AWWA C606 for use with mechanical couplings or bell-and-spigot ends with rubber gaskets. Bell-and-spigot ends for sizes less than 6 inches diameter shall be as required by AWWA C200.
  - 2. Fittings and specials shall be made of the same material as the pipe. Specials and fittings may be made of standard steel tube turns or segmentally welded sections, with ends to accommodate the type of couplings or joints specified for the pipe. The thickness rating of pipe fittings and specials shall be not less than the thickness specified and the pressure rating calculated for the pipe with which they are used. Protective materials for fittings and specials shall be as specified for the pipe. Specials and fittings that cannot be mechanically lined, coated, and wrapped shall be lined, coated, and wrapped by hand, using the same material used for the pipe with the same number of applications of each material, smoothly applied.
- b. Wall Thickness for Pipe and Fittings: The minimum metal thickness for steel pipe wall shall be 0.375 inch, based on steel having a yield strength of 36,000 psi. Wall thickness of steel pipe and fittings shall be determined by the manufacturer of the pipe and calculated in the following manner. Design for the following minimum conditions:

- Pressure rating.....200 psi
- Earth cover.....10 feet
- Water hammer.....40 percent of pressure rating
- Live load.....AASHTO H220-44 truck loading
- Allowable deflection.....2 percent of nominal pipe diameter

Calculate pipe wall thickness on the basis of an allowable fiber stress in the steel equal to 50 percent of the minimum yield strength of the steel used in the manufacture of the pipe. Design procedure shall be in accordance with the methods given in AWWA M11, Chapter 4, "Determination of Pipe Wall Thickness," Chapter 5, "Water Hammer and Pressure Surge," and Chapter 6, "External Load."

The value of E', modulus of soil reaction, does not apply because then steel pipe is only located in exposed conditions. Wall thickness of fittings shall be not less than that required for the pipe. Fittings shall be designed to withstand the hydrostatic pressure test specified herein in paragraphs entitled "Testing Procedure," and "Special Testing Requirements." When necessary to meet the pressure test requirements, fittings shall be reinforced in accordance with methods given in AWWA M11, Chapter 13, "Supplementary Design Data and Details."

c. Joints and Jointing Materials

(1) Joints: Joints for pipe and fittings shall be welded joints, or flanged joints, as indicated. Joints shall be grooved type where indicated. Provide insulating joints where indicated. Grooved type joints may be used in lieu of flanged joints.

(2) Welded Joints: Electrodes shall be of the quality specified in AWWA C206.

(3) Sleeve-Type Mechanical Coupled Joints: As specified in paragraph entitled "Sleeve-Type Mechanical Couplings."

(4) Grooved Type Joints: Pipe ends shall be grooved by roll grooving or shall have welded-on adapters with cut grooves. Grooves made by roll grooving shall have dimensions as recommended by the coupling manufacturer. Cut grooves in adapters shall have dimensions conforming to AWWA C606. Joint dimensions shall be as specified in AWWA C606 for rigid joint, except that where joints are indicated to be flexible, joint dimensions shall be as specified for flexible joints.

(5) Flanged Joints: Provide pipe ends with steel flanges, AWWA C207; Class D. Bolts and nuts for flanged connections, AWWA C207. Rubber gaskets, AWWA C207; asbestos gaskets will not be allowed.

(6) Insulating Joints: Design to prevent metal-to-metal contact at the joint between adjacent sections of piping. Joint shall be of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers. Gasket shall be of the dielectric type, full face, and in other respects as recommended in the Appendix to AWWA C115/A21.15. Bolts and nuts shall be as recommended in the Appendix to AWWA C115/A21.15.

d. Lining:

(1) Epoxy Lining: AWWA C210 or AWWA C213, standard thickness, shop-applied.

2.1.2 Valves, Hydrants, and Other Water Main Accessories

2.1.2.1 Gate Valves on Buried Piping

AWWA C509. Unless otherwise specified, valves conforming to: (1) AWWA C509 shall be nonrising stem type with solid-wedge gates and mechanical-joint ends or push-on joint ends as appropriate for the adjoining pipe, designed for a hydraulic working pressure of 175 psi. Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have

O-ring stem seals. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair. In lieu of mechanical-joint ends and push-on joint ends, valves may have special ends for connection to sleeve-type mechanical coupling. Valve ends and gaskets for connection to sleeve-type mechanical coupling shall conform to the applicable requirements specified respectively for the joint or coupling. Valves shall be of one manufacturer.

#### 2.1.2.2 Gate Valves In Exposed Or Aboveground Locations

AWWA C509. Unless otherwise specified, valves conforming to: (1) AWWA C509 shall be outside-screw-and-yoke rising-stem type with flanged ends and shall be designed for a hydraulic working pressure of 175 psi. Valves shall have solid-wedge gates. Provide valves with handwheels that open by counterclockwise rotation of the valve stem. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair. Valves shall be of one manufacturer.

#### 2.1.2.3 Rubber-Seated Butterfly Valves

Rubber-seated butterfly valves shall conform to the performance requirements of AWWA C504. Wafer type valves conforming to the performance requirements of AWWA C504 in all respects, but not meeting laying length requirements will be acceptable if supplied and installed with a spacer providing the specified laying length. All tests required by AWWA C504 shall be met. Flanged-end valves shall be installed in an approved pit and provided with a union or sleeve-type coupling in the pit to permit removal. Mechanical-end valves 3 through 10 inches in diameter may be direct burial if provided with a suitable valve box, means for manual operation, and an adjacent pipe joint to facilitate valve removal. Valve operators shall restrict closing to a rate requiring approximately 60 seconds, from fully open to fully closed.

#### 2.1.2.4 Check Valves

Swing-check type, AWWA C508 or UL 312. Valves conforming to: (1) AWWA C508 shall have iron or steel body and cover and flanged ends, and (2) UL 312 shall have cast iron or steel body and cover, flanged ends, and designed for a working pressure of 175 psi. Materials for UL 312 valves shall conform to the reference standards specified in AWWA C508. Valves shall have clear port opening. Valves shall be weight-loaded where indicated. Flanges shall be Class 125 conforming to ASME B16.1.

#### 2.1.2.5 Valve Boxes

Provide a valve box for each gate valve on buried piping. Valve boxes shall be of cast iron of a size suitable for the valve on which it is to be used and shall be adjustable. Cast-iron boxes shall have a minimum cover and wall thickness of 3/16 inch. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches. Cast-iron box shall have a heavy coat of bituminous paint.

#### 2.1.2.6 Sleeve-Type Mechanical Couplings

Couplings shall be designed to couple plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections. The coupling shall consist of one middle ring flared or beveled at each end to provide a gasket seat; two follower rings; two resilient tapered rubber gaskets; and bolts and nuts to draw the follower rings toward each other to compress the

gaskets. The middle ring and the follower rings shall be true circular sections free from irregularities, flat spots, and surface defects; the design shall provide for confinement and compression of the gaskets. For ductile iron and PVC plastic pipe, the middle ring shall be of cast-iron and the follower rings shall be of malleable or ductile iron. Cast iron, ASTM A 48/A 48M, not less than Class 25. Malleable and ductile iron shall conform to ASTM A 47/A 47M and ASTM A 536, respectively. Gaskets shall be designed for resistance to set after installation and shall meet the applicable requirements specified for gaskets for mechanical joint in AWWA C111. Bolts shall be track-head type, ASTM A 307, Grade A, with nuts, ASTM A 563, Grade A; or round-head square-neck type bolts, ANSI B18.5.2.1M and ASME B18.5.2.2M with hex nuts, ASME B18.2.2. Bolts shall be 5/8 inch in diameter; minimum number of bolts for each coupling shall be 4 for 4 inch and 6 inch pipe, 6 for 8 inch and 10 inch pipe, and 8 for 12 inch pipe. Bolt holes in follower rings shall be of a shape to hold fast the necks of the bolts used. Mechanically coupled joints using a sleeve-type mechanical coupling shall not be used as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint. Mechanical couplings shall provide a tight flexible joint under all reasonable conditions, such as pipe movements caused by expansion, contraction, slight setting or shifting in the ground, minor variations in trench gradients, and traffic vibrations. Couplings shall be of strength not less than the adjoining pipeline.

#### 2.1.2.7 Tracer Wire for Nonmetallic Piping

Provide bare copper wire not less than 0.10 inch in diameter in sufficient length to be continuous over each separate run of nonmetallic pipe.

#### 2.1.2.8 Fire Hydrants

Wet-barrel type. Paint hydrants with at least one coat of primer and two coats of yellow enamel paint, except use red enamel paint for tops of hydrants in non-potable water systems. The Contractor shall stencil the hydrant number and main size on the hydrant barrel using black stencil paint. Coordinate numbering with Code F Fire Protection Engineer.

- a. Wet-Barrel Type Fire Hydrants: Wet-barrel type hydrants, AWWA C503 or UL 246, "Wet Barrel" design, shall have 6 inch inlet, one 4-1/2 in pumper connection, and two 2½ inch hose connections. Hydrants shall be Clow Model 860 or equivalent. Pumper connection and hose connections shall be individually valved with independent nozzle gate valves. Inlet shall have mechanical-joint end only, except where flanged end is indicated; end shall conform to the applicable requirements as specified for the joint. Size and shape of operating nut, cap nuts, and threads on hose and pumper connections shall be as specified in AWWA C503 or UL 246. Hydrants are indicated as "traffic type," shall have breakable features as mentioned in AWWA C503. The traffic type hydrant shall have special couplings joining upper and lower sections of hydrant barrel and upper and lower sections of hydrant stem and shall be designed to have the special couplings break from a force not less than that which would be imposed by a moving vehicle; hydrant shall incorporate an internal mainline check valve to automatically limit uncontrolled discharge and related damage resulting from an impact event; the chck valve shall operate to close the main valve inlet, while leaving a "tell tale" stram of water to indicate damage; the chck valve shall be repairable without special tools and hydrant shall operate properly under

normal conditions.

#### 2.1.2.9 Vacuum and Air Relief Valves

Vacuum and air relief valves shall be of the size shown and shall be of a type that will release air and prevent the formation of a vacuum. The valves shall automatically release air when the lines are being filled with water and shall admit air into the lines when water is being withdrawn in excess of the inflow. Valves shall be iron body with bronze trim and stainless steel float. Each valve shall be fitted with a carbon steel vented cover to prevent accidental damage as shown.

#### 2.1.2.10 Pressure Reducing Valves

Pressure Reducing valves shall maintain a constant downstream pressure regardless of fluctuations in demand. Valves shall be suitable for 200 psi operating pressure on the inlet side, with the outlet pressure set to match the existing PRV being replaced (less than 150 psi). The valves shall be of the hydraulically operated, pilot controlled, globe or angle type, and may be actuated either by diaphragm or piston. The pilot control shall be the diaphragm operated, adjustable, spring loaded type, designed to permit flow when controlling pressure exceeds the spring setting. Ends shall match the existing piping receiving the pressure reducing valve. Valve bodies shall be bronze, cast iron, or cast steel with bronze trim. Valve stem shall be stainless steel. Valve disks and diaphragms shall be synthetic rubber. Valve seats shall be bronze, Pilot controls shall be bronze with stainless steel working parts.

#### 2.1.2.11 Indicator Posts

UL 789. Provide for gate valves where indicated.

#### 2.1.2.12 Turbine Type Meters

Turbine type meters shall conform to AWWA C701 Class II, The main casing shall be bronze or cast iron protected by corrosion resistant coating with stainless steel external fasteners. Registers shall be straight-reading type, shall be permanently sealed and shall read in U.S. gallons. Connections shall be suitable to the type of pipe and conditions encountered. Meter shall be fitted with an encoder type remote register designed in accordance with AWWA C707. Meters shall comply with the accuracy and capacity requirements of AWWA C701.

#### 2.1.2.13 Strainer

Each strainer shall be a wye-pattern style assembly with cast iron body, flanged end connections, and a 50-micron size stainless steel sediment filter strainer element. Size shall be as indicated. Each strainer element shall be located upstream of a backflow preventer assembly or flowmeter as indicated.

#### 2.1.2.14 Single Check Valve Detector Assembly (SCVDA)

Where indicated, fire department connections shall be protected by a single check valve detector assembly with upstream OS&Y gate valve and a 3/4 inch and turbine flow meter and check valve by-pass line.

## 2.2 WATER SERVICE LINE MATERIALS

### 2.2.1 Piping Materials

#### 2.2.1.1 Copper Pipe and Associated Fittings

Pipe, ASTM B 42, regular, threaded ends. Fittings shall be brass or bronze, ASME B16.15, 125 pound.

#### 2.2.1.2 Plastic Piping

Plastic pipe and fittings shall bear the seal of the National Sanitation Foundation (NSF) for potable water service. Plastic pipe and fittings shall be supplied from the same manufacturer.

- a. Polyvinyl Chloride (PVC) Plastic Piping with Screw Joints:  
ASTM D 1785, Schedule 80; or ASTM D 2241, with SDR as necessary to provide 150 psi minimum pressure rating. Fittings, ASTM D 2466 or ASTM D 2467. Pipe and fittings shall be of the same PVC plastic material and shall be one of the following pipe/fitting combinations, as marked on the pipe and fitting, respectively: PVC 2120/PVC II; PVC 2116/PVC II. Solvent cement for jointing, ASTM D 2564. Pipe couplings, when used shall be tested as required by ASTM D 2464.

- b. Polyvinyl Chloride (PVC) Plastic Piping with Elastomeric-Gasket Joints:

Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 80, with joints meeting the requirements of 150 psi working pressure, 200 psi hydrostatic test pressure, unless otherwise shown or specified.

- c. Polyvinyl Chloride (PVC) Plastic Piping with Solvent Cement Joints:

Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 150 psi working pressure and 200 psi hydrostatic test pressure.

- d. Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe:  
AWWA C909, plain end or gasket bell end, Pressure Class 150 with cast iron pipe equivalent outside diameter.

#### 2.2.1.3 Insulating Joints

Joints between pipe of dissimilar metals shall have a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact between adjacent sections of piping.

### 2.2.2 Water Service Line Appurtenances

#### 2.2.2.1 Service Clamps

Service clamps used for repairing damaged cast-iron, copper, or PVC pipe shall have a pressure rating not less than that of the pipe to be connected and shall be the double flattened strap type. Clamps shall have a bronze body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

#### 2.2.2.2 Dielectric Fittings

Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

#### 2.2.2.3 Check Valves

Check valves shall be designed for a minimum working pressure of 150 psi or as indicated. Valves shall have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when inlet pressure is greater than the discharge pressure, and shall close tightly to prevent return flow when discharge pressure exceeds inlet pressure. The size of the valve, working pressure, manufacturer's name, initials, or trademark shall be cast on the body of each valve. Valves 2 inches and larger shall be outside lever and weight type.

- a. Valves 2 inches and smaller shall be all bronze designed for screwed fittings, and shall conform to MSS SP-80, Class 150, Types 3 and 4 as suitable for the application.

#### 2.2.2.4 Gate Valves 3 Inch Size and Larger on Buried Piping

Gate valves 3 inch size and larger on buried piping AWWA C509 and of one manufacturer. Valves, AWWA C509, nonrising stem type with solid-wedge gates. Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have O-ring stem seals and shall be bolted and constructed so as to permit easy removal of parts for repair. Valves shall have end connections appropriate to the pipe being connected.

#### 2.2.2.5 Gate Valves Smaller than 3 Inch in Size

Gate valves smaller than 3 inch size MSS SP-80, Class 150, solid wedge, nonrising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve. Provide handwheel operators.

#### 2.2.2.6 Gate Valve 3 Inch Size and Larger

Gate valves 3 inch size and larger in exposed locations, AWWA C509 and of one make. Valves conforming to: (1) AWWA C509 shall be outside-screw-and-yoke rising-stem type with flanged ends and solid-wedge gates. Materials for AWWA C509 valves shall conform to the reference standards specified in AWWA C500. Provide valves with handwheels that open by a counterclockwise rotation of the valve stem. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair.

#### 2.2.2.7 Gate Valves Smaller Than 3 Inch Size in Exposed Locations

MSS SP-80, Class 150, solid wedge, inside screw, rising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve and a handwheel operator.

#### 2.2.2.8 Valve Boxes

Provide a valve box for each gate valve on buried piping. Valve boxes shall be of cast iron of a size suitable for the valve on which it is to be used

and shall be adjustable. Provide a round head. Cast the word "WATER" on the lid. The least diameter of the shaft of the box shall be 5 1/4 inches. Cast-iron box shall have a heavy coat of bituminous paint.

#### 2.2.2.9 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 150 psi. Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 50 foot-pound.

#### 2.2.2.10 Service Saddle

Service saddles shall be installed to tap water mains as indicated and as specified herein. Saddles shall be bronze double strap type. Saddles shall be fabricated of 85-5-5-5 cast bronze. Gaskets shall be Grade 60, compounded to resist saltwater. Straps and nuts shall be copper silicon alloy 651 bolt temper, conforming to ASTM A 98. Washers shall be silicon bronze. Tap sizes shall be as indicated. Service saddles shall have a pressure rating not less than that of the service pipe being connected.

#### 2.2.2.11 Insulation

To protect backflow preventer assemblies against damage caused by extremes of temperature, each exposed pipe and backflow preventer assembly shall be wrapped with a 1/2-inch thickness of fiberglass blanket insulation and the insulation shall receive an outer wrap of weather-proof tape and a UV-resistant covering. The insulation, wrap, and covering shall not interfere with the proper operation of the backflow preventer.

### 2.3 Reduced Pressure Principle Backflow Preventer Assemblies

AWWA C511 reduced pressure principle type backflow preventer assemblies, line size as indicated. Backflow preventer assemblies shall have threaded connections and all bronze construction for sizes of 2 inches and smaller, and shall have flanged connections and galvanized cast-iron or epoxy-coated cast-iron construction for sizes larger than 2 inches. Each backflow preventer assembly shall include two check valves located between two shutoff valves with an area of reduced pressure between the check valves and a relief device arranged to discharge to the surrounding atmosphere. Fluctuations in piping pressure shall not cause cycling. The reduced pressure principle type of backflow preventer assembly shall automatically maintain a low pressure zone to positively prevent the backflow of water into the water supply system. The reduced pressure principle type of backflow preventer assembly shall automatically indicate failure of any part vital to the prevention of backflow by the continuous discharge from the relief device. Each backflow preventer assembly shall be suitable for a cold water working pressure of not less than 150 psi. The backflow preventer assembly shall be designed so that any moving part may be replaced without removing the backflow preventer assembly from the pipeline being protected. Shutoff valves shall be full-port ball valves for

sizes 2 inch and smaller, and shall be OS&Y type resilient wedge gate valves for sizes larger than 2 inches. Each backflow preventer assembly shall be equipped with: an in-line wye-style bronze strainer with 20 mesh screen on the inlet connection; and test adapter cocks to facilitate future tests/certifications. To the maximum extent practicable, all backflow preventer assemblies shall be the standard product of one manufacturer.

#### 2.3.1 Certificate of Approval

Furnish a Certificate Of Full Approval or a Current Certificate of Approval for each design, size, and make of backflow preventer assembly being provided. Each certificate shall be from the Foundation For Cross-Connection Control and Hydraulic Research, University of Southern California (FCCCHR-USC), and shall attest that this design, size, and make of backflow preventer has satisfactorily passed the complete sequence of performance tests and evaluations for the respective level of approval. A Certificate Of Provisional Approval will not be acceptable in lieu of the above.

#### 2.3.2 Approved Backflow Prevention Assemblies

All backflow prevention assemblies to be provided shall be included on the current list of backflow prevention assemblies published by FCCCHR List. Notify the Contracting Officer when ant backflow preventer assembly to be repaired or tested/certified is not on the approved list. Any backflow preventer assembly not on the approved list shall be replaced with a currently listed approved backflow preventer assembly, as specified herein.

#### 2.3.3 RBPB Enclosure

The enclosure shall be designed to protect the RPDP assembly against accidental damage, vandalism, and temperture extremes (both heat and cold). The enclosure shall be an insulated pre-fabricated assembly made of 18-guage, mill-finished aluminum. The assembly shall be secured with metTchanical fasteners to form a durable and vandall-resistant structure. The enclosure shall be insulated internally with 1-1/2 inch t layer of spray-applied unicellular foam insulation t to provide a minimum R-value of 8 and the ability to protect the RBPB device against damage from overnight temperatureures of -30 degrees F. The enclosure shall be secured to the concrete pad using a four-pronged interior latching mechanism. The enclosure shall comply with ASSE 1060.

#### 2.4 RELINING EXISTING TANKS

##### 2.4.1 Dewatering, Cleaning, and Preparation for Relining

Existing Tank NB103 (390,000 gallon capacity) and Tank NB108 (500,000 gallon cpacity) shall have their interior surfaces (including the roofs) cleaned, abrasive blasted (sandblasted) and relined as indicated. The tanks shall be relined such that only one tank is out of service at any time and the remaining tank is full of water during that same time period in order to maintain fire protection capability. Each tank can only be dewatered once during the work and any related pipeline work requiring tank dewatering must be coordinated with the appropriate tank relining process. Contractor shall limit daily work to the area that can be sandblasted and relined in one day. Squencing of tank work and tank dewatering by NASA personnel shall be coordinated with the Contracting Officer.

#### 2.4.2 Relining Product Data

Each coating manufacturer's technical data, application instructions, Material Safety Data Sheets (MSDS), and certificate for compliance for VOC content shall be submitted to the Contracting Officer. Application, curing time, mixing and thinning of the coating materials shall be in strict accordance with the manufacturers instructions. The use of thinners shall not alter the required minimum dry thickness or adversely affect the VOC content.

##### 2.4.2.1 Dewatering and Surface Preparation

Each tank shall be dewatered in its turn by NASA personnel. The interior of each tank shall be cleaned of accumulated sediment, squeegee dried, and abrasive blast cleaned to near-white condition (2 - 3 mil surface profile) in accordance with SSPC SP 10 prior to relining.

##### 2.4.2.2 Interior Surfaces

The interior relining (coating) system shall be fully compatible with the requirements of NSF 61 for continuous contact with potable water. A prime coat at of least 3.0 mil average dry-film thickness and a final coat of at least 5.0 mil average dry-film thickness shall be applied to the cleaned surface. Each coat shall be a two-component catalyzed epoxy material.

### PART 3 EXECUTION

#### 3.1 INSTALLATION OF PIPELINES

##### 3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to all pipeline installation except where specific exception is made in the "Special Requirements..." paragraphs.

##### 3.1.1.1 Location of Water Lines

Terminate the work covered by this section at the points indicated. Where the location of the water line is not clearly defined by dimensions on the drawings, do not lay water line closer horizontally than 10 feet from any sewer line. Where water lines cross under gravity sewer lines, encase sewer line fully in concrete for a distance of at least 10 feet on each side of the crossing, unless sewer line is made of pressure pipe with rubber-gasketed joints and no joint is located within 3 feet horizontally of the crossing. Lay water lines which cross sewer force mains and inverted siphons at least 2 feet above these sewer lines; when joints in the sewer line are closer than 3 feet horizontally from the water line, encase these joints in concrete. Do not lay water lines in the same trench with gas lines, fuel lines, or electric wiring. Copper piping shall not be installed in the same trench with ferrous piping materials. Where nonferrous metallic pipe, e.g. copper piping, cross any ferrous piping, provide a minimum vertical separation of 12 inches between pipes.

Where water piping is required to be installed within 1 m 3 feet of existing structures, the water pipe shall be sleeved as required in Paragraph "Casting Pipe". The Contractor shall install the water pipe and sleeve ensuring that there will be no damage to the structures and no settlement or movement of foundations or footings.

#### 3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 23 00.00 20, EXCAVATION AND FILL.

#### 3.1.1.3 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, fittings, valves, or any other water line material into trenches. Cut pipe in a neat workmanlike manner accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying. Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at proper elevation and grade. Secure firm, uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where indicated and where necessary for fastening work into place. Make proper provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation. Depth of cover over top of pipe shall not be less than 3 1/2 feet (42 inches).

#### 3.1.1.4 Installation of Tracer Wire

Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

#### 3.1.1.5 Connections to Existing Water Lines

Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped and as indicated.

#### 3.1.1.6 Penetrations

Pipe passing through walls of structures shall be provided with ductile-iron or Schedule 40 steel wall sleeves. Annular space between walls and sleeves shall be filled with rich cement mortar. Annular space between pipe and sleeves shall be filled with mastic.

#### 3.1.1.7 Flanged Pipe

Flanged pipe shall only be installed above ground or with the flanges in valve pits.

### 3.1.2 Special Requirements for Installation of Water Mains

#### 3.1.2.1 Installation of Ductile-Iron Piping

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

- a. Jointing: Make push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly. Make mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and the recommendations of Appendix A to AWWA C111. Make flanged joints with the gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange. When flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified, replace it by one of proper dimensions. Use setscrewed flanges to make flanged joints where conditions prevent the use of full-length flanged pipe and assemble in accordance with the recommendations of the setscrewed flange manufacturer. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer. Make grooved type joints with the couplings previously specified for this type joint connecting pipe with the grooved ends specified for this type joint; assemble in accordance with the recommendations of the coupling manufacturer. Groove pipe in the field only with approved groove cutting equipment designed especially for the purpose and produced by a manufacturer of grooved joint couplings; secure approval for field-cut grooves before assembling the joint. Make insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints, except that bolts with insulating sleeves shall be full size for the bolt holes. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.
- b. Allowable Deflection: The maximum allowable deflection shall be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.
- c. Pipe Anchorage: Provide concrete thrust blocks (reaction backing), setscrewed flanges (restrained joints), or metal harness for pipe anchorage, except where restrained joints or metal harness is specifically indicated. Thrust blocks shall be in accordance with the requirements of AWWA C600 for thrust restraint, except that size and positioning of thrust blocks shall be as indicated. Use

concrete, ASTM C 94/C 94M, having a minimum compressive strength of 3,000 psi at 28 days. Metal harness shall be in accordance with the requirements of AWWA C600 for thrust restraint, using tie rods and clamps as shown in NFPA 24, except as otherwise indicated. Setscrew flanges shall be installed along the pipeline for a minimum distance of 90 feet on either side of the joint or fitting being restrained.

- d. Exterior Protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet, using Class A or Class C polyethylene film, in accordance with AWWA C105.

#### 3.1.2.2 Installation of PVC Plastic Water Main Pipe

Installation of PVC Plastic Water Main Pipe and Associated Fittings: Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines"; with the requirements of UBPPA UNI-B-3 for laying of pipe, joining PVC pipe to fittings and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation."

- a. Jointing: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use an approved lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of UBPPA UNI-B-3 for laying the pipe and the recommendations in AWWA M23, Chapter 7, "Installation," for pipe joint assembly. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint; assemble in accordance with the requirements of UBPPA UNI-B-3 for joining PVC pipe to fittings and accessories, with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111. Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.
- b. Offset: Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer, but shall not exceed 5 degrees.
- c. Pipe Anchorage: Provide concrete thrust blocks (reaction backing), sescrewed flanges (restrained joint), or metal harness for pipe anchorage, except where metal harness is indicated. Thrust blocks shall be in accordance with the requirements of UBPPA UNI-B-3 for

reaction or thrust blocking and plugging of dead ends, except that size and positioning of thrust blocks shall be as indicated. Use concrete, ASTM C 94/C 94M, having a minimum compressive strength of 3,000 psi at 28 days. Metal harness shall be as indicated. Setscrew flanges shall be installed along the pipeline for a minimum distance of 90 feet on either side of the joint or fitting being restrained.

- d. Fittings: Install in accordance with AWWA C605.

### 3.1.2.3 Installation of Valves and Hydrants

- a. Installation of Valves: Install gate valves, AWWA C509, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509. Install gate valves on PVC water mains in accordance with the recommendations for appurtenance installation in AWWA M23, Chapter 7, "Installation." Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation. Make and assemble joints to gate valves and check valves as specified for making and assembling the same type joints between pipe and fittings.

### 3.1.3 Installation of Water Service Piping

#### 3.1.3.1 Location

Connect water service piping and appurtenances where indicated.

#### 3.1.3.2 Service Line Connections to Water Mains

Connect service lines and appurtenances as indicated.

### 3.1.4 Special Requirements for Installation of Water Service Piping

#### 3.1.4.1 Installation of Metallic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the applicable requirements of AWWA C600 for pipe installation, unless otherwise specified.

- a. Jointing:

(1) Screwed Joints: Make screwed joints up tight with a stiff mixture of graphite and oil, inert filler and oil, or graphite compound; apply to male threads only. Threads shall be full cut; do not leave more than three threads on the pipe exposed after assembling the joint.

(2) Joints for Copper Piping: Cut copper pipe with square ends; remove fins and burrs. Handle pipe carefully; replace dented, gouged, or otherwise damaged pipe with undamaged pipe. Make solder joints using ASTM B 32, 95-5 tin-antimony or Grade Sn96 solder. Solder and flux shall contain not more than 0.2 percent lead. Before making joint, clean ends of pipe and inside of fitting or coupling with wire brush or abrasive. Apply a rosin flux to the pipe end and on recess inside of fitting or coupling. Insert pipe end into fitting or coupling for the full depth of the recess and

solder. For compression joints on flared tubing, insert tubing through the coupling nut and flare tubing.

(3) Flanged Joints: Make flanged joints up tight, taking care to avoid undue strain on flanges, valves, fittings, and accessories.

#### 3.1.4.2 Installation of Plastic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the applicable requirements of ASTM D 2774 and ASTM D 2855, unless otherwise specified. Handle solvent cements used to join plastic piping in accordance with ASTM F 402.

- a. Jointing: Make solvent-cemented joints for PVC plastic piping using the solvent cement previously specified for this material; assemble joints in accordance with ASTM D 2855. Make plastic pipe joints to other pipe materials in accordance with the recommendations of the plastic pipe manufacturer.
- b. Plastic Pipe Connections to Appurtenances: Connect plastic pipe service lines to backflow preventer assemblies and gate valves in accordance with the recommendations of the plastic pipe manufacturer.

#### 3.1.5 Flushing And Disinfection

Flush new water piping to remove sediment, pipe cuttings, and other debris prior to disinfection or use. Prior to disinfection, obtain Contracting Officer approval of the proposed method for disposal of waste water from disinfection procedures. Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a certified laboratory, and submit the results prior to the new water piping being placed into service. Disinfection of systems supplying nonpotable water is not required.

### 3.2 FIELD QUALITY CONTROL

#### 3.2.1 Field Tests and Inspections

Prior to hydrostatic testing, obtain Contracting Officer approval of the proposed method for disposal of waste water from hydrostatic testing. The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the drawings and specifications. Do not begin testing on any section of a buried pipeline where concrete thrust blocks have been provided until at least 5 days after placing of the concrete.

### 3.2.2 Testing Procedure

Test water mains and water service lines in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements." Test ductile-iron water mains and water service lines in accordance with the requirements of AWWA C600 for hydrostatic testing. The amount of leakage on ductile-iron pipelines with mechanical-joints or push-on joints shall not exceed the amounts given in AWWA C600; no leakage will be allowed at joints made by any other method. Test PVC plastic water mains and water service lines made with PVC plastic water main pipe in accordance with the requirements of UBPPA UNI-B-3 for pressure and leakage tests. The amount of leakage on pipelines made of PVC plastic water main pipe shall not exceed the amounts given in UBPPA UNI-B-3, except that at joints made with sleeve-type mechanical couplings, no leakage will be allowed. Test water service lines in accordance with applicable requirements of AWWA C600 for hydrostatic testing. No leakage will be allowed at copper pipe joints, copper tubing joints (soldered, compression type, brazed), plastic pipe joints, or flanged joints.

### 3.2.3 Special Testing Requirements

For pressure test, generally use a hydrostatic pressure 50 psi greater than the maximum working pressure of the system, except that: for those portions of the system having pipe size larger than 2 inches in diameter, hydrostatic test pressure shall be not less than 200 psi; and for those portions of the system having pipe size smaller than 2 inches in diameter, hydrostatic test pressure shall be not less than 150 psi. Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test. Perform all testing requirements in accordance with NFPA 24.

### 3.3 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --