



DACA41-03-R-0008

**US Army Corps  
of Engineers**  
Kansas City District  
*Heartland Engineers*

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*Construction of*

**CORROSION CONTROL FACILITIES  
PHASE I  
FY03  
PRQE045002P1**

**MCCONNEL AFB  
KANSAS**

**Volume One  
POL/Refueler Maintenance Facility  
Technical Specifications**

**June 2003**

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## STATEMENT OF WORK

[04/03]

## PART 1 PROJECT SCOPE OF WORK

## 1.1 GENERAL

This contract includes all design and construction necessary to provide the following complete and usable facilities:

a. Petroleum, Oil and Lubricants (POL) Operation Center. This facility will serve as the "nerve" center for all POL activities. The gross area of the facility is approximately 4,251 square feet. The POL Ops Center is a single story structure to be located on the site of existing refueler vehicle parking. Demolition of existing pavement will be required. The building exterior will be similar in appearance to the attached POL Ops Center elevations and be in compliance with the McConnell AFB Architectural Compatibility Guide.

b. Refueler Maintenance Facility. This facility will serve as the primary maintenance facility for the base's fleet of refueler vehicles. The gross area of the facility is approximately 5,601 square feet (base bid), or 6,861 GSF if the bid alternate for an inspection bay is exercised. The Refueler Maintenance Facility will be a single story structure, located on a vacant lot South of the Fuels Storage Yard. The building exterior will be similar in appearance to the attached Refueler Maintenance Facility elevations and be in compliance with the McConnell AFB Architectural Compatibility Guide.

c. Military Fuel Pumps and Canopy (Bid Alternate). This facility will serve as the base's primary Government vehicle fueling station. Two (2) dual nozzle fuel pumps will be provided. The pumps will be set on a raised concrete island and are to be protected by concrete bulkheads. Selective demolition of existing curbs, gutters and pavement is required. New concrete curbs, gutters and pavement will be provided as indicated on the attached site plan. A steel framed hip roof canopy measuring approximately 44'-0" x 52'-0" will provide protection from the elements. The appearance of the canopy will be similar to the attached Military Fuel Pump Canopy elevations and be in full compliance with the McConnell AFB Architectural Compatibility Guide.

d. Site development. Includes all required supporting utility services, paved access roads, sidewalks, curbs and gutters, parking areas for both Privately Owned Vehicles and Government Owned Vehicles (including refueler vehicles), demolition of existing curbs, gutters and pavement, and other site improvements described in this Request for Proposal and shown on the enclosed conceptual drawings.

Project requirements include structural standing seam metal roofs, handicap access, exterior lighting, security fencing, CCTV system, energy monitoring and controls, fire protection and alarm systems, HVAC systems, communication system, and electrical service. Structural considerations include seismic design. AT/FP measurements include laminated glass, traffic control barriers, barrier landscaping and 25 meter (82-foot) stand-off distances between the structure and roads and parking areas.

Verification of existing site conditions, site surveys, geotechnical investigations, and all other information required for design and construction of a complete and usable facilities are the express responsibility of the Contractor.

NOTE: The term "Proposer" will be read as "Contractor" following contract award.

## 1.2 PROJECT LOCATION AND PROPOSED SITE PLANS

McConnell AFB, KS is located approximately 180 miles Southwest of Kansas City, Missouri. A location map depicting the various facilities to be constructed is included in this RFP.

## 1.3 GOALS AND OBJECTIVES

The existing POL Ops Center and Refueler Maintenance Facility are currently located in the footprint of a future hanger facility. This project's goal is to relocate the current facilities outside the proposed hanger footprint while still maintaining reasonable proximity between POL facilities.

## 1.4 COORDINATION OF PLANS AND SPECIFICATIONS

The importance of careful checking and coordination of plans, specifications and other project documents cannot be overemphasized. It shall be the responsibility of the CONTRACTOR to check and coordinate all project data prior to all submittals. Deficiencies, ambiguities, conflicts and inconsistencies shall be rectified prior to submittal of documents. The letter of transmittal shall certify that all documents have been checked and coordinated prior to submittal and it shall be signed by a principal of the CONTRACTOR firm.

## 1.5 CRITERIA

The design criteria included in the Request for Proposal are intended to serve as a minimum standard for the CONTRACTOR in the preparation of a proposal for professional services which will satisfactorily meet design and construction standards for the proposed project. Criteria to be followed in this project are as follows (Many of these documents can be obtained from <http://www.hnd.usace.mil> (select TECHINFO)):

- a. Engineering Technical Letters (ETLs) - OCE. The listing is ETL 1110-3-355, latest edition. See TECHINFO for current list.
- b. Army Technical Manuals. See TECHINFO for current list.
- c. Architectural and Engineering Instructions, Design Criteria, latest edition. See <http://www.nws.usace.army.mil/PublicMenu>
- d. U.S. Army Corps of Engineers Safety and Health Requirements Manual EM 385-1-1, dated Sept 96.
- e. U.S. Army Corps of Engineers -- See Techinfo for current list.
  1. ER 1110-345-700 Design Analysis, Drawings, and Specifications
  2. ER1110-1-8155 Specifications

## 1.6 DRAWINGS

All drawings shall be prepared in accordance with ER 1110-345-700. Design criteria and referenced drawings furnished by the Government are intended to serve as a minimum standard for the CONTRACTOR in the preparation of acceptable working drawings and specifications. Applicable details of these drawings shall be incorporated into the working drawings and specifications without reference to their source. Incorporation by reference only is not acceptable.

## 1.7 USE OF COMPUTER-AIDED DESIGN AND DRAFTING (CADD) SYSTEMS

All drawings provided under this contract shall be accomplished and developed using Computer-Aided Design and Drafting (CADD) software and procedures conforming to the following criteria.

### 1.7.1 CADD Data

All CADD data shall be supplied in Auto desk, Inca., on AutoCADD, release 2002 or higher (preferably 2002), native electronic digital format (i.e., .dwg), with Windows, version 2000 or greater operating system. The target platform is IBM Compatible, personal computer, with Windows, version 98 or greater operating system. The A-E shall ensure that all digital files and data (e.g., base files, reference file, cell libraries) are compatible with the Government's target CADD system (i.e., basic and advance CADD software, platform, database software), and adhere to the standards and requirements specified herein. The term "compatible" means that data can be accessed directly by target CADD system without translation, preprocessing, or postprocessing of the electronic digital data files. It is the responsibility of the A-E to ensure this level compatibility. This includes full functionality of associated databases.

### 1.7.2 CADD Standards

CADD Standards. The A-E will provide a Compact Disc, Read-Only Memory (CD-ROM) containing all project files, which can be read and processed by the Government's target CADD system. The external label for each electronic media shall contain, as a minimum, the following information:

- a. The contract number, project name and date.
- b. The format and version of operating system software.
- c. The name and version of utility software used for preparation (Ed.g., compression/uncompression) and copy files to the media.
- d. The sequence number of the digital media.
- e. A list of filenames.

## 1.8 SPECIFICATIONS

Specifications shall be prepared using Corps of Engineers Unified Facilities Guide Specifications or Abbreviated Guide Specifications and in accordance with ER 1110-1-8155. The CONTRACTOR will complete the items listed below.

- . Table of Contents and Indices

- . Sheet & drawing numbers, title and date for each drawing
- . Listing of Government-furnished Contractor Installed Equipment
- . List of Shop Drawing Submittals

The CONTRACTOR shall incorporate Government edited specifications, provided in the RFP, into the project specifications. The contractor shall include these in both the prefinal and final submittals.

#### 1.9 DESIGN ANALYSIS

The design analysis shall be prepared in accordance with the guidance provided in ER 1110-345-700. The final design analysis will be updated and revised to reflect review comments and development of the final design.

#### 1.10 SUBMITTAL REGISTER

The CONTRACTOR shall complete the Title And Location and Specification Section blocks and columns c through p of ENG Form 4288, Submittal Register, dated May 91. It is necessary to provide a minimum of one sheet of ENG Form 4288 for each specification section. No more than one submittal should be put on a line. Blank forms are available upon request.

#### 1.11 COST ESTIMATES

The contractor shall provide detailed cost estimates for any criteria or modification changes requested by the Government. The estimate will include both design and construction costs for any such change.

#### 1.12 RENDERING REQUIREMENTS

The A-E shall coordinate with the Government project manager. The buildings will be represented from an eye level view or aerial view at relative scale. The rendering shall show all as built conditions to include landscaping and all mechanical and electrical equipment. The rendering shall match the colors of the building exterior and interior finishes. All original color renderings shall be hand painted. The minimum size for the rendering shall be determined by adding the vertical and horizontal dimensions (without matte), with their sum equaling 42 inches. Allow a minimum 2 inch border around the rendering, 3 to 4 inch border/ matte is preferred. The full size rendering (original and photos) shall be double matted as follows: upper matte sheet shall be a neutral color with a lower sheet of contrasting and complementary color. The rendering shall be labeled with the project, base and A-E on the border/matting. The lettering shall be Helvetica type style letters. Use ½-inch tall letter for the building title and base name. The city, state, and contractor shall be ¼-inch tall lettering. There will be two submittals; prefinal and final.

##### 1.12.1 Prefinal

The prefinal submittal shall be a black and white draft sketch of the rendering. The draft sketch (wire drawing) can be hand drawn or painted or computer generated. This draft shall have the detail of the final rendering. The A-E shall make copies and distribution in accordance with the rendering distribution table. (See attached table.) After the prefinal submittal has been reviewed by the government, the A-E shall meet with the government at the Kansas City District Offices. This meeting shall resolve any Government comments and allow the A-E to discuss the details of the final rendering.

### 1.12.2 Final

All original color rendering shall be hand painted. The final submittal shall include the original with matte, full size color photos with matte, 8.5" x 11" color photos, mounted 35mm color slides, and 4" x 5" color negative of the original rendering. All full size color photos and the original shall be framed with commercially available aluminum frame sections that are one (1) inch deep and ¼ inch wide at the face. The framing shall, as a minimum, be 1/8 inch non glare plastic. The frames shall be complete with hardware attached and ready to hang. Distribution and quantities shall be made in accordance with the rendering distribution table. The frames must be packed in a manner to avoid breakage and damage to the frame or artwork.

### 1.13 DESIGN COMPLETION SCHEDULE

The design time is included in the overall completion time for the contract. The contractor shall develop a design schedule that allows 21 day government review period for each submittal review. The one day review conference will follow the 21-day review period. CAUTION: The contractor is cautioned that for each Contractor's resubmittal required beyond the initial submittal and one resubmittal for correction by the Contracting Officer, the Contractor Officer will assess an Administrative Deduction in the amount of \$500.00 from the progress payment(s) due the Contractor.

### 1.14 SUBMITTAL REQUIREMENTS

All submittals are to be sent by express mail or other expeditious means. Distribution of each design submittal will be made by the CONTRACTOR directly to the reviewing agencies with the required number of copies as indicated on the submissions listing. The contractor shall furnish a separate CID schedule following the requirements in "Comprehensive Interior Design Requirements" which incorporates the following milestones.

#### 1.14.1 Letter of Transmittal

A letter of transmittal identifying the submission and listing material being submitted shall accompany each submission. The letter shall be referenced to the project by title, number and location.

#### 1.14.2 Corrected Final Submittal

The corrected final submittal of original drawings, specifications, design analysis shall be transmitted by registered or guaranteed mail.

### 1.15 DESIGN SUBMITTAL AND REVIEW

The Contractor may elect to use either fast track method or standard design build. The selection of method must be in the management plan.

#### 1.15.1 Standard Design-Build Method Submittal

Design documents shall be furnished in four (4) submittals.

#### 1.15.2 Fast Track Method Submittal

Design documents shall be furnished in five (5) submittals.

##### 1.15.2.1 Preliminary (35 Percent) Submittal

The preliminary submittal shall be reviewed at McConnell AFB. The Government will provide the conference room for the meeting. The preliminary submittal shall have two (2) volumes. Volume 1 shall be the Fast Track and the 100% designed package. Volume 2 shall constitute 35% design of the remaining elements except the CID package.

Volume 1

Drawings 100% for:

- Site Plans (diminsions, striping, etc.
- Site drainage
- Site utilities
- Site layout/ standoff distances
- Site demo
- Foundation plan (Contractor's discretion) \*
- Subfloor utilities (Contractor's discretion) \*
- All details for the aforementioned plans
- Complete specifications for work shown in drawings and complete design analysis for the aforementioned plans
- Draft ENG Form 4288 (on CD or 3.5" disk) for the aforementioned specifications

Note: Site work is considered all work five feet outside of the building foundation.

\* All the following structural requirements for the entire addition must be met by the Contractor prior to the construction of the foundation.

- a. The Contractor must have complete and approved final (100% complete) design analysis. The design analysis shall include complete detailed calculations showing the analysis and the design of the gravity and the lateral load resisting systems.
- b. Locations of the gravity and the lateral load-carrying elements and the foundation loads must be finalized prior to the design of foundations.
- c. Approved final drawings showing the locations of the vertical and lateral load resisting system including the redundancies provided for the lateral load resisting system.
- d. Approved foundation shop drawings showing the size and the spacing of the reinforcement.
- e. Approved final drawings showing base plate design, anchor bolt layout details and embedded items
- f. Approved complete design, including reinforcing bar locations, for concrete masonry walls and reinforced concrete walls

Subfloor utilities shall have all design calculations in the design analysis verifying sizes and capacities.

Volume 2

- Drawings 50% complete
- One typed specification from each discipline
- Design Analysis

1.15.2.2 Final Fast Track Submittal

The final fast track submission provides project documents (Volume 1 of 35% submittal) that are ready for construction, all corrected to reflect review conference comments. Using the quantities and distribution based on the numbers shown in the final column of the distribution list, the CONTRACTOR shall furnish the following:

- Completed construction drawings
- Typed construction specifications
- Updated design analysis
- Updated ENG Form 4288 (on CD or 3.5" disk)

#### 1.15.2.3 Prefinal Submittal (Standard Design-Build Method)

The prefinal submittal shall be a complete set of documents that could be used for construction purposes without review. A prefinal review conference will be held at McConnell AFB, KS. One of the CONTRACTOR'S personnel from each major discipline involved in the design and the Project Manager shall attend. This submission incorporates the preliminary review comments and includes the following.

- Completed drawings (incorporating the 35% review comments)
- Typed specifications
- Updated design analysis with the preliminary annotated comments
- Draft ENG Form 4288 (on CD or 3.5" disk)
- Comprehensive Interior Design (CID) Concept

#### 1.15.2.4 Final Submittal

The final submission provides project documents that are ready for construction, all corrected to reflect final review conference comments. The CONTRACTOR shall furnish the following.

- Completed construction drawings
- Typed construction specifications
- Updated design analysis
- Updated ENG Form 4288 (on CD or 3.5" disk)

#### 1.15.2.5 Final CD Submittal

The final (100%) CID shall be submitted within 90 calendar days following the approval of the design for construction.

#### 1.15.3 Preliminary Submittal

Preliminary (35 Percent) Submittal. The preliminary submittal shall have a review at McConnell AFB. The Government will provide the conference room for the meeting. The preliminary submittal shall include the following items:

- . Drawings 50% complete
- . One typed specification from each discipline.
- . Design Analysis

#### 1.15.4 Prefinal Submittal

The prefinal submittal shall be a complete set of documents that could be used for construction purposes without review. A prefinal review conference will be held at McConnell AFB, KS. The CONTRACTOR shall furnish

one person from each major discipline involved in the design and the Project Manager to attend. This submission incorporates the preliminary review comments and includes:

- . Completed drawings (incorporating the 35 percent review comments)
- . Typed specifications
- . Updated design analysis with the preliminary annotated comments.
- . Draft ENG Form 4288 (on CD or 3.5" disk)
- . Comprehensive Interior Design (CID) Concept

#### 1.15.5 Final Submittal

The final submission provides project documents that are ready for construction, all corrected to reflect final review conference comments. The CONTRACTOR will furnish:

- . Completed construction drawings
- . Typed construction specifications
- . Updated design analysis
- . Updated ENG Form 4288 (on CD or 3.5" disk)

#### 1.15.6 Final CID Submittal

The final (100%)CID shall be submitted within 90 days following the approval of the design for construction.

### 1.16 GENERAL REQUIREMENTS AND STANDARDS

#### 1.16.1 Fire Protection Plan

Fire Protection Plan. (MCA) All building design shall be in conformance with Unified Facilities Criteria (UFC) 3-600-01, Design: Fire Protection Engineering For Facilities dated 17 April 2003. A fire protection plan and/or diagram shall be developed for each project and submitted with the final submittal.

#### 1.16.2 Site Inspection

The Government has provided site and soils information within the Request for Proposal (RFP) for the contractor's use in preparing the proposal and subsequent design. The contractor shall be responsible to determine if additional investigations, surveys, or other site data is required and include this in his RFP proposal design costs. The CONTRACTOR is responsible for making the necessary field visits to assess existing conditions. Underground utilities and conditions not depicted in the RFP will be adjusted by modification as determined by the contracting officer.

#### 1.16.3 Conferences

The CONTRACTOR shall be represented by personnel familiar with all aspects of the work submitted. The CONTRACTOR will be responsible for taking notes and preparing the minutes for all conferences. Conference notes will be prepared in typed form and the original furnished this office, within 5 days after date of conference, for concurrence and distribution. These minutes shall include the date, place and a list of attendees, including organization and telephone number. Comments made during the conference, or decisions affecting criteria changes, must be recorded in the basic conference notes. Any augmentation of written comments should be documented by the conference notes. Written comments presented by

attendees shall be attached to each report with the conference action noted. Conference action shall be "A" for an approved comment, "D" for a disapproved comment, "W" for a comment that has been withdrawn, and "E" for a comment that has an exception noted. Note comments not incorporated and provide a brief explanation for rejection.

#### 1.16.4 Site Survey and Subsurface Explorations

A Topographic Survey, Subsoil Investigations Data and a Foundation Analysis will be furnished by the Government. The soils report will be included in the design analysis. Boring logs and basic soils design assumptions shall be shown on the drawings.

##### Topographic Maps

- a. Sufficient bench marks and monuments to serve during preparation of the site plan and during actual construction.
- b. Shape of the ground by contour lines and by spot elevations at all significant points. Contour interval will be one foot where the average slope of the site is three percent or less, two feet where the average slope is up to 15 percent, and five feet for steeper average slopes. Spot elevations on which contours are based will also be indicated on the map.
- c. Elevations of streets and curbs by spot elevations at all significant points.
- d. Existing site facilities, such as buildings, parking areas, roads, walks, fences, and retaining walls.
- e. Water courses, ponds, etc., and the elevation of high water if possible.
- f. Rock outcrops by accurate outlines and by enough points of elevation to indicate their shape.
- g. Data on existing trees, including location, identification by common name, diameter of trunk (four feet above the ground), approximate spread of branches, and average ground elevation at the base of isolated trees six inches or more in caliper, principal trees on property lines, and along margins of woods, the largest and best trees within woods at the rate of not less than 16 per acre, and foliage outlines for edges of woods and for masses of shrubby vegetation.

#### 1.16.5 Utility Map

This map will show all utility easements or rights-of-way; location, size and invert elevations of existing sanitary sewers; storm drains or open drainage channels, drain inlets and manholes; location and size of existing water, gas and steam mains and underground conduits; location of existing overhead electric power, street lighting, and telephone lines, including pole locations; location of rail lines and rights-of-way; location of fire alarm call boxes and similar appurtenances.

#### 1.16.6 Project Manager

The CONTRACTOR shall assign a principal or key employee to serve as the Project Manager. The Project Manager shall oversee the coordination of the entire project design and shall be capable of administering all instructions from this office and obtaining answers to all questions from

this office during and after the design work. During the prosecution of the work under the contract, the CONTRACTOR shall keep in close liaison with the Corps of Engineers Design Project Manager (PM), who will coordinate the work with the Using Service and other agencies. All requests made by the Using Service and other agencies shall be referred to the PM. At appropriate times, representatives of the Contracting Officer may review the progress and technical adequacy of the work. Such review will not relieve the CONTRACTOR from performing all contract requirements, except as may be waived by written instruction from the Contracting Officer.

#### 1.16.7 Disposal of PCBs and PCB Items

Contract documents will reflect full compliance with EPA regulations for the handling, storage, marking and disposal of PCBs and PCB items such as oil filled transformers and fluorescent ballasts. All PCB residues are to be turned over to the local Defense Property Disposal Office for disposal.

#### 1.16.8 Color Schedule

The CONTRACTOR shall develop a detailed schedule of all colors for all surfaces and finishes, i.e., painted surfaces, floor covering, tile, counter tops, etc. The detailed schedule shall be based on the basic schedule and shall be incorporated into the contract drawings and specifications. Color chips shall be approved by the user prior to final submittal.

#### 1.17 DESIGN OF ADDITIONS AND MODIFICATIONS TO EXISTING FACILITIES

The design of additions and/or modifications to existing facilities shall include all changes to the existing construction, utility systems, and site improvements as required to provide for the proper connection between existing and new construction and make the modified or altered facility completely operable for its intended use. New construction, within limitations of current criteria, shall match existing construction.

##### 1.17.1 Design of Utilities, Utility Protection, and Utility Relocation

Work shall include the design of all interior and exterior utilities required to support the project; it shall also include the design of any required protection of any existing utilities which will be affected by construction of the work designed under this contract. Work shall also include the design of any relocation or modification of federally-owned existing utilities which will be affected. Where necessary, existing interior and exterior utility systems and services shall be resized as required to provide for loads imposed by the new work.

##### 1.17.2 Contract Drawings and Specifications

Contract drawings and specification prepared shall provide for all required modifications and extensions of existing construction, utilities and site improvements. The Government will furnish available "as-built" or construction drawings pertinent to the facilities involved. Such drawings, however, may not show the existing conditions correctly. Therefore, all data shown on such drawings shall be verified by the CONTRACTOR and the CONTRACTOR shall obtain all other data as required to insure the complete and proper design of the project.

##### 1.17.3 Existing Utility Lines

The Contracting Officer will furnish all available data pertaining to all utility lines known to exist at and in the immediate vicinity of the project site. The CONTRACTOR shall verify by field reconnaissance the current location of all such utility lines and of any additional utility lines. In the event that field reconnaissance reveals any conditions differing from the Government-furnished data, the CONTRACTOR shall advise the Contracting Officer in writing or by phone at the earliest practicable date. The Contracting Officer will review the findings and make a determination.

#### 1.17.4 Site Improvements

The term "site improvements" shall be construed to mean all fill, grading, top-soiling, seeding, planting, roads, walks, access drives, parking areas, hardstands, fencing, and similar features. Work shall include the design of all site improvements, shall blend with and properly join with the existing improvements in adjacent areas.

### 1.18 DESIGN ACTIVITIES DURING CONSTRUCTION

#### 1.18.1 Checking of Shop Drawings

Contractor's designer shall check and recommend approval, or disapproval, of all shop and working drawings, including catalog cuts, diagrams, and samples required for the selection of material and/or colors, and other descriptive data, pursuant to the technical provisions of the construction specifications approved by the government.

##### 1.18.1.1 Shop Drawing Submittal

The Contractor shall submit five (5) copies of the shop and working drawings, catalog cuts, diagrams, and ENG Form 4025 to the Resident Engineer for review and approval. Any notes or changes shall be incorporated on all copies of the drawings, catalog cuts, etc. Action codes are contained on ENG Form 4025.

##### 1.18.1.2 Field Fit and Dimensions

The Contractor is responsible for field fit and dimensions.

#### 1.18.2 Design Services During Construction

The Contractor shall perform necessary design services during construction including: visits to the site, preparation of modifications to the plans and specifications for user-requested changes and changed field conditions, necessary estimates for budgeting possible changes and for funding and negotiating the contract changes.

### 1.19 CONTRACTOR DESIGN RESPONSIBILITY

#### 1.19.1 Design Errors

This contract will remain in force until construction of the project has been completed. During this period, the CONTRACTOR will be responsible for the correction of any design errors or deficiencies and any reconstruction costs resulting therefrom. Should design changes as a result of revised criteria be required during this period, the CONTRACTOR may be required to perform the necessary redesign work. In those instances, the contract will be modified accordingly, including an adjustment in the contract amount.

1.19.2 Additional Effort

Should the CONTRACTOR receive any direction or criteria that is not included in this contract that requires additional effort beyond the contract criteria, the Contracting Officer shall be notified in writing describing the change(s) impact on the effort.

1.19.3 Shop Drawing Approval

CONTRACTOR approval of contractor shop drawings which are inconsistent with the CONTRACTOR's approved design, and which prove to be inadequate for design intent, could be considered a design error or deficiency and handled accordingly.

1.20 AS-BUILT DRAWINGS

As built drawings shall be prepared by the CONTRACTOR upon completion of the project. Contract drawings will be revised and corrected to indicate actual construction of the facility, including all change-orders. Site plans, building plans, cross sections and elevations, schedules and all other portions of the drawings including location of mechanical service, utility lines and outlets, shall be revised to provide a clear understanding of the facility, as built. The "as built" drawing shall be provided as AutoCadd 2000 files on compact disk and one complete set of mylar as-build drawings.

DISTRIBUTION TABLE

OFFICE	PRELIMINARY	PREFINAL	FINAL
Kansas City District Corps of Engineers ATTN: PM-MO/Ray ATTN: PM-MO/Ray Specifications 601 E 12th Kansas City, MO 64106	8 Half Size 8 Design Analysis 1 CID Documents	10 Half Size 10 Design Analysis 10 Specifications 1 CID Documents	5 Half Size 5 Design Analysis 5
HQ AMC/CECW ATTN: Robert Moore 507 Symington Drive Scott AFB, IL 62225	3 Half Size 3 Design Analyses 3 Specifications	3 Half Size 3 Design Analyses 3 Specifications 1 Specifications 1 CID Document	1 Half Size 1 Design Analysis 1 CID Document
22 CES/CEC ATTN: Anjana Dossa 5300 Hutchinson McConnell AFB, KS 67221	12 Half Size 3 Design Analyses	12 Half Size 3 Design Analyses 12 Specifications 1 CID Document	12 Half Size 1 Design Analysis 12 Specifi- cations 2 CID Documents
Ft. Riley Area Office ATTN: John Schwartsbeck	3 Half Size 3 Design Analyses	3 Half Size 3 Design Analyses	10 Half Size 10 Design

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HQ AMC/CECW Scott AFB, IL	1 Half Size	1 Half Size with Frame
	1 Full Size	1 Full Size with Frame
		1 35 mm Color Slide 1 4" x 5" Color Negative
22 CES/CEC McConnell AFB, KS	1 Half Size	4 Half Size with Frame
	1 Full Size	1 Full Size with Frame
		1 Original with Frame
		2 35 mm Color Slide 1 4" x 5" Color Negative

PART 2 CODES AND STANDARDS

The proposed facilities will be designed and constructed in accordance with the applicable codes, standards, design parameters (McConnell AFB Installation Design Guide), regulations and other criteria provided in the following sections of this RFP. In case of conflict between these requirements, the most stringent will apply, unless otherwise directed by the Contracting Officer. References pertain to standard specifications of any technical society, organization or association, or to codes, manuals, regulations, specification, or tentative specification adopted and published at least 90 days prior to submittal of proposal, unless specifically stated otherwise. When any code or standard references the "governmental authority" or the authority having "jurisdiction", this reference will be interpreted as referring to the Contracting Officer.

Military criteria and guide specifications are available on the following internet sites:

- [www.usace.army.mil/inet/usace.docs](http://www.usace.army.mil/inet/usace.docs)
- [www.hnd.usace.army.mil/techinfo/instruct.htm](http://www.hnd.usace.army.mil/techinfo/instruct.htm)

Additional information is available in the McConnell AFB Architectural Compatibility Guide, included with RFP on compact Disk.

2.1 SUSTAINABLE DESIGN REQUIREMENTS

The design of this project will produce environmentally sustainable facilities in accordance with the Army's Engineering Technical Letter (ETL) No. 1110-3-491 (1 May 2001) available at website:  
<http://www.hnd.usace.army.mil/techinfo/engpubs.htm/>. The POL Ops Center and Refueler Maintenance Facility, as a minimum, will achieve a Bronze level rating in accordance with the Army's "SpiRiT" rating system as described and detailed in Appendix C of the ETL 1110-3-491. The Contractor will use

methods and materials in the facility design to include site, building construction, and mechanical and electrical systems that promote and utilize sustainable design principles. Facility design sustainable features and the corresponding SPiRiT rating will be clearly defined and detailed in the design analysis.

-- End of Section --

## SECTION 01011

## GEOTECHNICAL

**[01/02]**

## PART 1 GENERAL

## 1.1 REFERENCES

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

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556	(2000) Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
ASTM D 1557	(2000) 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 1586	(1999) Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.
ASTM D 1587	(2000) Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes.
ASTM D 2166	(2000) Standard Test Method for Unconfined Compressive Strength of Cohesive Soil.
ASTM D 2216	(1998) Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
ASTM D 2487	(2000) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
ASTM D 2922	(1996) Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
ASTM D 2937	(2000) Standard Test Method for Density of Soil in Place by the Drive Cylinder Method.
ASTM D 3017	(1996) Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
ASTM D 4718	(1987) Standard Practice for Correction of Unit Weight and Water Content for Soils

Containing Oversize Particles (Rev. 1994,  
1996).

U.S. ARMY CORPS OF ENGINEERS

TI 809-04

(1998) Seismic Design for Buildings

## 1.2 Geotechnical Design Parameters

All recommendations in the Geotechnical Report for the Corrosion Control Facility May 2003 shall be considered the minimum design criteria. Specifications developed pertaining to earthwork, grading, pavements or other geotechnical items, developed by the contractor, shall be in accordance and in agreement with the geotechnical report. This report is attached to the RFP document.

## PART 2 PRODUCTS

Not Used

## PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01012

SITE WORK/CIVIL/UTILITIES

PART 1 GENERAL

1.1 REFERENCES

DEPARTMENT OF THE ARMY/Air Force

- TM 5-822-5 (June 92) Pavement Design for Roads, Streets Walks, and Open Storage Areas [Ref: AFM 88-7, Chap. 1]
- TM 5-813-5 (3 Nov 86) Water Supply, Water Distribution [Ref: AFM 88-10, Vol 5]
- TM 5-813-7 (2 Sep 86) Water Supply for Special Project [Ref: AFM 88-10, Vol 7}]
- TM 5-814-1 (4 Mar 85) Sanitary and Industrial Wastewater Collection - Gravity Sewers and Appurtenances [Ref: AFM 88-11, Vol 1]
- TM 5-814-2 (15 Mar 85) Sanitary and Industrial Wastewater Collection-- Pumping Stations and Force Mains [Ref: AFM 88-11, Vol 2]
- (15 Mar 85) Sanitary and Industrial Wastewater Collection-- Pumping Stations and Force Mains [Ref: AFM 88-11, Vol 2]

AMERICAN WATER WORKS ASSOCIATION (AWWA)

- AWWA C651 (1992)Disinfecting Water Mains

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

- NOAA ATLAS 2 (1973) Precipitation-Frequency Atlas of the Western United States

National Institute of Standards and Technology (NIST)

- NIST 44 (Current Edition) Weights and Measures Handbook 44
- UFC 4-010-01 DoD Minimum Antiterrorism Standards for Buildings

## 1.2 NOT USED

## 1.3 SURVEY

### 1.3.1 Field Survey.

The engineering survey to be used in the development of the design submittal is available to the Contractor on CD-ROM furnished with this solicitation. The information is in a 3-d Bentley Microstation drawing file. The survey data information was gathered by a topographical survey performed in December 2002 to April 2003. Contours were gathered at 1 foot intervals. The survey drawings shall be used by the Contractor to prepare for development of design drawings. Any additional survey information required by the Contractor for preparation of his proposal or for development of design drawings shall be obtained by the Contractor at his own expense.

## 1.4 STAGING AND CONTRACTORS ACCESS

### 1.4.1 Staging Area

The location of the Contractor staging area shall be within the project limits as shown on the drawings. Contractor private vehicles shall not be allowed inside of the project limits but must park outside. Contractor vehicles shall be marked with the company name. Staging area shall be returned to its original condition or improved condition if indicated in the contract upon completion of construction.

### 1.4.2 Contractors Access Route

The Contractor's Access Route shall be through the west gate.

## 1.5 DEMOLITION

The buildings noted on the Demolition Plan and Bid Schedule to be demolished are included in the project. Floor plans and wall sections drawings have been provided if available. Soil removal/remediation is required as indicated on the plans. The Contractor shall remove all pavements, utilities and other appurtenances necessary to construct the new facility. Disposal shall be off base at contractor expense. The Contractor shall notify the Contracting Officer if any material to be disposed of is found to contain hazardous, toxic, biological or radiological substances. Rubbish and debris shall be removed from the site on a daily basis to avoid accumulation at the project site. Demolition shall conform to Unified Facilities Guide Specification (UFGS) Section 02220 DEMOLITION. Burining is not allowed. Foundations shall be removed to a depth of at least 42 inches. Fence posts and fence mow strips to be removed shall be removed entirely. The Air Force reserves salvage rights to all materials until building or structure is turned over to the contractor. Special scheduling is required as some facilities must be completed by the contractor before demolition may begin. The POL facility is an example. Demolition of an Oil Water Seperator is required. Refer to Specification 02000 OUTLINE SPECIFICATIONS for requirements. Note the requirements under fencing to salvage, protect, crate, and deliver for the Air Force gates, controls, and motors.

OIL Water Separator requirement:

#### 1.6 NEW CONSTRUCTION

The location and construction shall be as indicated on the attached drawings and in the specifications.

New utility service lines shall consist of sanitary sewers, waterlines, gas lines, electrical power and communications lines. All utility lines installed shall have a plastic marker tape minimum 6 inches (15 centimeters) wide by 0.4 inch (.01 centimeter) thick installed 8 to 10 inches below grade. The plastic marker tape shall include a metallic wire for detection purposes and shall bear a continuous printed inscription describing the type of utility line buried below. Metal pipes, (including ductile iron) and valves shall be cathodically protected and include test stations.

The exact limits are part of the design effort and depend on the existing pavements, design traffic and proposed construction.

##### 1.6.1 Building

Location and construction of structures, roads, parking, utilities and landscaping shall be as indicated on the attached drawings and as specified herein. The new buildings shall be handicap accessible. Minor changes to the overall layout may be accepted by the Government if it is beneficial to the overall design of the project.

##### 1.6.2 Walks

Exterior concrete walks 4 inches thick shall be placed to connect POV parking and buildings as needed. Walks shall have a medium broom finish. Adjustments to the walk layout may be made to facilitate the final Site Plan. Walks along the parking lots shall be a minimum of 10 foot wide. Walks leading to the main entrance shall be a minimum of eight feet wide and match the width of the front facade of the building. Walks leading to all other entrances shall be a minimum of 5 feet wide. Walks 10 foot wide shall have a five foot square joint pattern.

##### 1.6.3 Parking Areas

As a minimum, curbs or wheel stops shall be used to maintain the AT/FP setback from vehicles to buildings. Parking areas are indicated on the Site Plan and shall be located a minimum of 25 meters (82 feet) from the building main entrance. Provide, as a minimum, the number of parking spaces as indicated on the Site Plan. Two Handicap van-accessible universal stalls in accordance with January 1998 Accessibility Guidelines for Buildings and Facilities, Appendix (with striping, signage, and ramps) shall be provided for the POL building. Adjustments to the parking lots as shown may be made but must be approved by the Government. The number of parking stalls shall be as shown on the drawings. Regular parking stalls shall be a minimum of 9.5 feet wide and 20 feet long. Driving lanes shall be a minimum of 2-12 feet wide. Parking stalls shall be delineated with 4 inch white stripes. Pavement design shall be the responsibility of the contractor according to the geotechnical report. Provide integral curb, double purpose walk, or concrete curb and gutter. Contractor shall use installation design standard designs, for example, use the 24 inch wide curb and gutter that is standard for MAFB.

See Section 01700: ELECTRICAL for exterior lighting requirements.

#### 1.6.4 Screen Walls/Dumpster Enclosure

Construct screen walls to block the view of exterior mechanical equipment from vehicular and pedestrian traffic. Top of screen wall shall be no less than 12 inches higher than the top of any portion of the mechanical equipment unless noted otherwise. Also, construct concrete dumpster pad(s) with a three-sided screen wall enclosure with wood gate. Screen walls shall be constructed in accordance with the installation standard design guide.. The dumpster enclosure shall be constructed in accordance with the installation standard design guide. Concrete walks to the dumpster pad and a concrete approach pad (if approach if not directly from a concrete pavement) a minimum of 15 feet wide (center of bollard to center of bollard) by 12 feet deep by 8 feet high. Approach slab shall be portland cement concrete not less than 15 feet by 15 feet unless otherwise noted. Comply with the AT/FP requirements for walls, enclosures and stand off distance.

#### 1.6.5 Seeding

##### 1.6.12.1 Soil Preparation

Prior to seeding, all surface soils shall be loosened to a minimum depth of four inches and broken up to a fine, workable texture suitable for seeding.

##### 1.6.12.2 Seeding and/or Sodding

Turfed areas shall be seeded according to the installation guide. All newly turfed areas shall be fertilized with fertilizer at the rate and composition recommended by a soil test (submit FIO the test results to the COR. Seed shall be according to 01140 installation design guide at the rate and species indicated therein or 5 pounds per 1000 SF. (also called base standards).

***Seeding shall be specified in accordance with Section 02000 of this RFP document and UFGS Section 02921A SEEDING.***

***Sodding shall be specified in accordance with UFGS Section 02922A SODDING.***

#### 1.6.6 Fence and Gates

a. Fences shall be 7 foot high fabric with top and bottom tension wire.

Outriggers shall be constructed with barbed wire or ribbon wire atop the fence to match the adjacent fence. Post shape shall match the existing shape. Chain Link fencing shall be specified in UFGS Section 02821 FENCING.

New fencing shall be constructed before removal of fencing to be demolished so the security of the base may be maintained.

b. Cantilever gates for vehicle access shall be a minimum width of back of curb to back of curb or edge of pavement to edge of pavement wide unless otherwise noted on the drawings. Single swing personnel gates shall be a minimum of 4 feet wide. The height of the gates shall match the fence. Sliding, cantilever gates, motorized shall be required unless swing gates are indicated on the drawings. NEW gates and fences are required. Existing gates, motor and controls) (from this project shall be protected from damage and turned over and to the Base Civil Engineer. Controls, motors,

drive assemblies shall be crated for turnover. Refer to the drawings. New cantilever, motorized gates shall have two conduits each from the controls to two pedestal mounted, waterproof switch boxes. Switch/control box face shall be located 12 inches behind the back of curb where curbs exist and 6 inches away from the road edge of pavement where there is no curb. . Gates shall be specified in UFGS Section 02821 FENCING.

c. All chain link fences constructed (permanent) shall have a concrete mow strip installed no more than one inch (25 mm below the bottom) tension wire. The mow strip shall be 6 inches deep by 12 inches wide with two No. 4 bars running parallel to the fence line. The top 6 inches of the fence post base shall be 12 inches by 12 inches square to accommodate the placement of 12.7 mm preformed expansion joints on each side of the fence post foundation.

d. Fence fabric for fences and gates shall have a PVC coating as specified in UFGS Section 02821, color shall be black .

#### 1.6.7 CONSTRUCTION AREA FENCING

The Contractor shall maintain a 6' high chain link fence around the construction areas. Chain Link fencing shall be as specified in UFGS Section 02821 FENCING. Orange safety fence may be used around the parking lots and utility construction. Upon completion of construction, all fence materials shall be disposed of outside the limits of Government-controlled lands. A free zone fence shall be constructed to prevent construction worker from accidentally walking outside the construction limit toward the flight line. This fence may be an orange snow fence or the chain link, temporary construction fence. This fence shall be the first work in each area to preclude workers from wandering into and being challenged by Air Force security forces.

#### 1.7 Exterior Gas Distribution

A new service line shall be provided and connected by tapping into the existing gas line. Service lines to buildings shall run parallel and/or perpendicular to the building lines, shall be buried at least 18 inches below the ground surface, shall not be laid in the same trench with other utilities, and shall be above other utilities whenever they cross. Gas lines shall not be laid under paved streets, parking lots, roads or in other locations subject to heavy traffic whenever practicably avoidable. Whenever it is necessary to locate gas lines in such locations, the lines shall be protected by suitable encasement or by burying to a depth to provide at least 4 feet of cover over the top of the pipe except that gas lines shall be provided with encasement (minimum 12 x 12 inches) when laid under new or existing paved streets, and parking lots. The tap into the existing line shall be a "hot tap" and the Installation's Fire Department shall be given 30 days advance notification of the date of the tap. The point of connection shall be provided with a shutoff plug valve, conveniently located outside of any traffic area and protected with a valve box. Service lines shall not be installed under or routed thru the facility. Except for piping located at the new gas meter/service regulator assemblies, no aboveground gas piping shall be exposed to view. The service line shall enter the building in an accessible location outside the mechanical room. The gas meter/service regulator assemblies shall be hidden from view to the greatest extent possible. Gas Distribution System shall include annodless risers at buildings and meters at each building. PE piping is required. Steel components shall be cathodically protected and include test stations.

## 1.8 Exterior Water Distribution

Water service line shall tap into the existing water lines. Minimum cover for water mains and fire lines shall be according to the base standards. All valves shall be protected with bituminous coating. Mains and piping shall be disinfected in accordance with AWWA manual C-651. Fire hydrants shall be UL listed dry barrel type with break away flange and shall match in appearance and threading those presently in use on the installation. Hydrant laterals shall be 6-inch(152 mm) minimum size, and shall have an underground shutoff valve with an adjustable valve box in each lateral within 10 feet(3 meters) of the hydrant. Hydrants shall be set to provide 24 inches(610 mm ) from finished ground to top nut of hydrant and 460 mm (18 inches) to center of pumper connection. Metal pipes, (including ductile iron) and valves shall be cathodically protected and include test stations. All plugs, caps, tees, bends, and hydrants on water mains and hydrant laterals shall be provided with reaction backing or movement prevented by attaching metal tie rods or clamps. Water line valves shall be provided for all water service lines. Valve boxes shall be provided for all valves and shall extend to finished grade. The facility shall be provided with an interior service main cutoff valve. Material shall be as required by the Base Standard. Seperate fire (with PIV) and domestic water lines shall be as required by the Base Standard.

## 1.9 Exterior Sanitary Sewer

Sanitary sewer connection shall be to the existing system. Manholes are required in changes in direction, slope and where required to keep the maximum length between manholes or building exit to 300 feet. An exterior cleanout or manhole is required for each building within 5 feet of the building exit. Cleanouts shall have a minimum collar of 18x18x6 inches. Plug shall be recessed type. Material shall be as required by the Base Standard..

## 1.10 Exterior Electric and Communications Distribution

Location of power and communications shall be as shown on the drawings. See SECTION 01017 ELECTRICAL REQUIREMENTS for additional information and requirements.

## 1.11 PAVEMENTS

### 1.11.1 Pavement Subgrade Preparation

Pavement subgrades shall be prepared, as a minimum, in accordance with the Corrosion Control Facility, Phase 1 Geotechnical Report recommendations.

### 1.11.2 Pavement Design

The Contractor shall use the pavement cross section in the Corrosion Control Facility Phase 1 Geotechnical Report as the minimum design pavement cross section.

#### 1.11.3.1 Asphalt Concrete Pavement

The Contractor shall use the pavement cross section in the Corrosion Control Facility Phase 1 Geotechnical Report as the minimum design pavement cross section.

1.11.3.2 Portland cement concrete pavements: This project requires limited surface areas to be paved with Portland cement concrete, and construction of small concrete slabs on grade.

The Contractor shall use the pavement cross section in the Corrosion Control Facility Phase 1 Geotechnical Report as the minimum design pavement cross section. In addition the following requirements pertain:

The maximum water/cement (cementitious) ratio shall not exceed 0.42 by weight. Aggregate shall conform to ASTM C 33 Class 5S, except that the coarse aggregate shall not show more than 40 percent loss after 500 revolutions when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. The maximum allowable limit on Coal and Lignite shall be 0.25 percent. The aggregate shall meet or exceed the State Specifications requirement for Durability Class I. Portland cement concrete shall contain at least 564 pounds of Portland cement per cubic yard. Portland cement shall conform to ASTM C 150 Type I or II, and conform to the low alkali requirement. All Portland cement for use in the work shall be obtained from the same source. Class F Fly Ash may be used up to a maximum limit of 20 percent of the cementitious content. Fly Ash shall conform to ASTM C 618, meeting the optional physical and chemical requirements and the limit on available alkalies, Tables 1, 2,3, and 4. Slump shall be measured at the location of placement at the form. Concrete placed using pumping methods, slump shall be measured at the discharge end of the pump line at the location of placement.

1.11.3 [Enter Appropriate Subpart Title Here] 1.11.4 Rigid Pavement Joint Layout

A typical joint layout for plain concrete road intersections is shown in Figure 13-1 of TM 5-822-5. A typical joint layout for plain concrete roads and parking areas is shown in Chapter 15 of TM 5-822-5. Odd-shaped slabs should be reinforced in two directions normal to each other using a minimum of 0.10 percent of steel in both directions. The entire area of the slab should be reinforced. An odd-shaped slab is considered to be one in which the longer dimension exceeds the shorter dimension by more than 25 percent or a slab which essentially is neither square nor rectangular. Odd-shaped slabs will generally be reinforced with steel welded wire fabric. Slabs in which a structure is placed shall also be reinforced with welded wire fabric. Each slab to be reinforced with welded wire fabric will be marked with an "R" on the joint layout plan. Details showing typical layout of joints at intersection as indicated in Figure 13-1 of TM 5-822-5 will be provided when applicable. All joints in concrete pavement shall be cleaned and sealed with a joint sealant. All concrete shall be proportioned using a maximum water/cement ratio of less than 0.42 by weight.

1.11.4 [Enter Appropriate Subpart Title Here] Sidewalks

P.C. concrete sidewalks shall be a minimum of 150 mm thick. Transverse contraction joint spacing shall be as follows; 4 feet(1.2 m) for walks 4 and 8 feet(1.2 m and 2.4 m) wide, five feet(1.5 m) for walks five and 15 feet(1.5 m and 3.0 m) wide, six feet(1.8 m)for walks 6 and 12 feet (1.8 m and 3.6 m)wide. Longitudinal contraction joints shall be constructed in sidewalk widths 8 feet(2.4 m) and greater. Expansion joint spacing shall not exceed 40 feet(12.2 m). An expansion joint shall be provided at sidewalk intersections, between sidewalks and back of curbs, between sidewalks and vertical surfaces of structures, and between sidewalks and entrances to structures.

#### 1.11.5 Bituminous Prime Coat

A bituminous prime coat shall be used at the option of the Contractor. Bituminous prime coat will be used when it is anticipated that the constructed base course may be damaged by rain, wind, or traffic prior to placement of the bituminous concrete pavement.

#### 1.11.6 Bituminous Tack Coat

Contact surfaces of previously constructed pavement, curbs, manholes, and other structures shall be sprayed with a thin coat of bituminous material. Tack Coat shall conform to KDOT specifications.

#### 1.11.7 Joint Sealing

Joints in P.C. concrete pavements may be sealed with field molded sealants and specified in accordance with The Kansas Department of Transportation, "STANDARD SPECIFICATIONS FOR STATE ROAD AND BRIDGE CONSTRUCTION".

#### 1.11.8 Concrete Sidewalks, and Curbs and Gutters

Concrete sidewalks and curbs and gutters shall be specified in accordance with The Kansas Department of Transportation, "STANDARD SPECIFICATIONS FOR STATE ROAD AND BRIDGE CONSTRUCTION".

### 1.12 GRADING

#### 1.12.1 General

Positive drainage shall be provided for all areas and existing drainage ways shall be utilized to the extent possible. It is mandatory to direct drainage away from buildings to curb and gutter. Parking areas shall be graded such that storm water is directed off to the sides and not down the center of the parking area. Drainage along new entrance drives shall be controlled by the use of curb and gutter and drainage structures.

#### 1.12.2 Borrow and Waste

Borrow material shall be obtained from locations off base. Excess waste material shall be disposed of by the Contractor off base.

#### 1.12.3 Sidewalks

Concrete walks shall have a transverse grade of 2 percent. A desirable maximum longitudinal walk grade will be 4 percent with an absolute maximum of 8 percent. Handicapped accessible walks with a longitudinal slope greater than 5 percent shall be considered a ramp. See FED STD 795 Uniform Federal Accessibility Standards for ramp requirements. Special attention shall be given to sidewalks that are on the north (shaded) side of buildings. These walks should be designed to ensure a freeze/thaw cycle does not result in the formation of ice on the walk. Ice on walks should be a safety consideration for all areas. The use of steps in walks will be avoided whenever possible. The use of single riser steps is especially discouraged. When steps are unavoidable, they should have at least three risers and will be provided with handrails.

#### 1.12.4 Transverse Parking Area Grades

a. Desirable minimum of 2 percent.

b. Absolute minimum of 1.5 percent for flexible pavement and 1 percent for rigid pavement.

1.12.5 Longitudinal Parking Area Grades

Maximum of 4 percent.

1.12.6 Ramp Grades

a. Desirable maximum of 6 percent.

b. Absolute maximum of 8 percent for short distances only.

1.12.7 Gutter Grades

a. Desirable minimum of 0.8 percent.

b. Absolute minimum of 0.5 percent.

1.12.8 Building Floor Elevation

Building finished floor elevation shall be set to 6 inches higher than the surrounding grade, except for entrance ramps. A 6 inch step up at doors is acceptable for NON-HANDICAPED entrances.

1.12.9 Grades Away From Building

a. Minimum of 5 percent for 10 feet. Grades between buildings can be less than the minimum due to the close proximity of the structures. Care shall be taken in the design to ensure that this area drains properly. Contractor consideration shall be given to the use of area inlets, trench drains, etc. to provide adequate drainage. Exception is for paved areas adjacent to buildings.

b. Maximum of 10 percent for 10 feet.

1.12.10 Overlot Grades

Provide positive drainage for all areas.

a. Minimum 1 percent for cohesionless sandy soils.

b. Minimum 2 percent for cohesive soils or turfed areas.

c. Sideslopes for ditches, roads, and other turfed areas shall be no

steeper than 1V on 3H.

#### 1.12.11 Adjustment of Existing Structures

All manholes, valve boxes, handholes or inlets of any nature within the project that do not conform to the new finish grade in either surfaced or unsurfaced areas shall be adjusted to the new finish grade. Where inlets, manholes, valve boxes, or handholes fall within a surfaced or unpaved roadway or parking, the existing frames and cover shall be removed and replaced with a heavy-duty frame and cover. The structure shall be adjusted as needed to fit the new conditions.

#### 1.13 STORM DRAINAGE

##### 1.13.1 Determination of Storm Runoff

The computation of runoff may be accomplished by the Rational Method. Sizing of storm drainage systems shall be based on rainfall of 10-year frequency.

##### 1.13.1.1 Design Storm Return Period

Storm drains and culverts shall be sized for a design storm with a return period of 10 years. Provisions shall be made to protect all buildings and critical structures from a major storm with a return period of 100 years.

##### 1.13.1.2 Rainfall Depth-Duration-Frequency Data

Rainfall data for states in the western United States shall be obtained from NOAA ATLAS 2. Rainfall intensity-duration data developed by cities or regions may be used if available.

##### 1.13.2 Storm Drainage System Layout

The Contractor shall be responsible for the complete design of the storm drainage system. The new storm drainage system shall be coordinated with surrounding properties to ensure runoff does not cause damage to the other properties. Erosion control shall be provided for all storm drain structures. The Contractor shall provide details for all drainage structures. Under no circumstance shall storm drain lines be located beneath buildings.

##### 1.13.2.1 Manholes

Diameter of manholes shall be large enough to accommodate pipes entering and exiting the manhole. No ladders or steps are to be provided.

##### 1.13.2.2 Headwalls and Flared End Sections

Unless otherwise approved, headwalls or flared end sections shall be provided at the entrance and ends of culverts and at storm drain outfalls. Outlets and endwalls shall be protected from undermining, scour, lateral erosion.

##### 1.13.2.3 Culverts

Culvert pipes shall have a minimum diameter of 18 inches wherever possible.

#### 1.13.2.4 Roof Drain Outfall Lines

Downspouts and/or roof drains shall be connected to an underground roof drain system. Roof drain outfall lines beyond 5 feet from the building shall be of the same materials as the exterior storm drainage system. Minimum diameters shall be 12 inches for lengths over 50 feet and 8 inches for lengths under 50 feet. In addition, the diameter shall be at least 2 inches larger than the diameter of the line as it leaves the building (downspout). Downspouts shall connect to a transition boot (cast iron, color to match). Boot shall have a brass cleanout plug. Boot shall extend a minimum 6 inches below ground level and a minimum 24 inches above ground level. All changes in direction of outfall lines shall occur at storm drain structures except that cleanouts may be used in lines smaller than 12 inches.

#### 1.13.3 Storm Drain and Culvert Pipe

The Contractor shall select the appropriate storm drain and culvert pipe materials from the options specified in UFGS Section 02630 STORM DRAINAGE SYSTEM. RCP is preferred. Pipe, bedding, and backfill shall be of adequate strength (or stiffness) to support the earth, live, and construction loads imposed on the pipe. Only pipe materials which have a minimum design service life of 25 years shall be allowed for permanent installations. As a minimum, all pipe joints shall be soiltight. The Contractor shall specify watertight joints when the water table is at or above the pipeline.

##### 1.13.3.1 Concrete Pipe

Reinforced concrete pipe shall be a minimum Class III. Type I cement may be used only when sulfates in the soil are 0.1 percent or less and dissolved sulfates in the effluent are 150 ppm or less. Type II cement may be used only when sulfates in the soil are 0.2 percent or less and dissolved sulfates in the effluent are 1,500 ppm or less. Only Type V cement may be used if sulfates in the soil exceed 0.2 percent or dissolved sulfates in the effluent exceed 1,500 ppm. Concrete culverts and storm drains shall be protected by a minimum of 1.0 m of cover during construction to prevent damage before permitting heavy construction equipment to pass over them during construction.

##### 1.13.3.2 Corrugated Metal Pipe

The service life of corrugated metal pipe shall be the sum of the lives of the nonmetallic protective coating, the metallic protective coating, and the basic metal pipe. The life of the basic metal pipe and metallic protective coating shall be the time to first perforation. The time to first perforation for corrugated steel pipe shall be determined using the California Chart (California Division of Highways Test Method 643-B). Corrugated metal pipe shall not be allowed in areas where previous satisfactory service has not been achieved. Zinc-coated corrugated steel pipe shall not be allowed if the soil and water pH is less than 6 or greater than 8 or the minimum soil resistivity for the site is less than 2,500 ohm-cm. Aluminum-coated corrugated steel pipe shall not be allowed if the soil and water pH is less than 6 or greater than 9 or the minimum soil resistivity for the site is less than 1,500 ohm-cm. Stiffness of the corrugated metal pipe and soil envelope shall be such that the predicted long-term deflection shall not exceed 5.0 percent. Corrugated metal culverts and storm drains shall be protected by a minimum cover as recommended in Section 26 of AASHTO HB-16 during construction to prevent damage before permitting heavy construction equipment to pass over them

during construction. In general, Coated 14 gage CMP is the minimum that will meet the duration requirements.\*\*\*

#### 1.13.3.3 Plastic Pipe

Stiffness of the plastic pipe and soil envelope shall be such that the predicted long-term deflection shall not exceed 7.5 percent. Plastic culverts and storm drains shall be protected by a minimum of 1.0 m of cover during construction to prevent damage before permitting heavy construction equipment to pass over them during construction. Split couplers shall not be allowed for corrugated high-density polyethylene pipe.

#### 1.14 TRAFFIC SIGNAGE AND STRIPING

Traffic signage and striping shall be provided for all new roads and parking areas. Signage and striping shall be designed in accordance with the Manual on Uniform Traffic Control Devices for Streets and Highways.

#### 1.15 EROSION AND SEDIMENT CONTROL

The Contractor shall be responsible for selecting and implementing Best Management Practices (BMPs) to minimize pollutants in storm water discharges associated with construction activity at the construction site. All erosion and sediment measures and other protective measures shall be maintained by the Contractor in effective operating condition. All temporary structural practices shall be removed once the corresponding disturbed drainage area has been permanently stabilized. ***NPDES permit shall be required in accordance with the Kansas Department Of Health & Environment. Permit is required as area disturbed is over 1 acres. Permit can be obtained from industrial programs, stormwater program at (785) 296-5547. The internet website address is <http://www.kdhe.state.ks.us/stormwater/index.html>.***

##### 1.15.1 Temporary Construction Entrance

Tracking of mud from the construction site onto adjacent roads and streets shall be kept to a minimum. A temporary stabilized stone pad shall be constructed at points where vehicular traffic will be leaving the construction site and moving directly onto a paved road or street. It shall extend the full width of the vehicular ingress and egress area and have a minimum length of 70 feet. The entrance shall be maintained in a condition which will prevent tracking or flow of mud onto adjacent roads or streets. If conditions on the site are such that the majority of the mud is not removed by the vehicles traveling over the stone, then the tires of the vehicles shall be washed before entering the road or street. Any mud which is tracked onto roads or streets shall be removed at least once daily.

#### 1.16 COMPOSITE UTILITIES

The Contractor shall not run utilities underneath buildings. The Contractor shall avoid running utilities underneath streets and parking lots where practicable. In cases where it is necessary for the utilities to cross existing streets, the Contractor shall install the lines by trenchless excavation methods. No open trenching will be allowed through existing streets, unless written permission is obtained and approved by the installation.

##### 1.16.1 Service Line Tracer Wire

For new underground non-ferrous service lines are installed, the service lines shall be identified by a tracer wire to permit locating with a metal detector. Tracer wires shall be 12 gauge AWWG copper wire. The tracer wire shall be installed 150 mm above the pipe.

#### 1.16.2 Service Line Warning

New below grade lines shall be identified by placing a continuous plastic warning ribbon in the trench such that any excavation shall uncover the ribbon prior to reaching the line.

#### 1.16.3 CATHODIC PROTECTION

Corrosion protection shall be provided for all buried gray or ductile-iron piping, fittings, valves, and other water line appurtenances, regardless of pipe material. Corrosion protection shall consist of an anode type cathodic protection system. See SECTION 01017 ELECTRICAL REQUIREMENTS.

#### 1.16.4 WATERLINES

a. Waterlines shall be designed and constructed in accordance with the combination of the State of Kansas Department of Public Health and Environment's "*Design Criteria for Potable Water Systems (Revised March 31, 1997)*" and the Corps of Engineers Guide Specifications, Technical Manuals (TM), Engineering Manuals (EM), Military Handbooks (MH), and the industry standards listed herein. In the event of conflict, the Contractor shall follow the Local or State requirements/criteria (whichever are more stringent) which govern the waterlines. In addition to the State of Kansas criteria listed above, water distribution systems and service lines shall be designed and constructed in accordance with TM 5-813-5, TM 5-813-7, and UFGS Section 02510 WATER DISTRIBUTION SYSTEM. The Contractor shall be responsible for protection of existing waterlines. If any potable waterlines are damaged during construction, the Contractor must immediately notify the Contracting Officer. The Contractor shall disinfect all new water lines and any remaining lines which do not remain fully pressurized during construction or connection. The Contractor shall notify the Contracting Officer 7 days prior to disinfection of the water lines. The disinfection shall be in accordance with the American Water Works Association Standard AWWA C651, and shall not be considered complete until two consecutive days of bacteriological samples show no contamination. All bacteriological, lead and copper tests shall be performed by Environmental Protection Agency (EPA) certified laboratories. Copies of results of the analyses shall be forwarded to the Contracting Officer upon receipt.

b. The Contractor shall design and provide all facilities required to deliver water to the project. Service connections or extensions to the existing water distribution system shall be made without interruption to service. Sizing of the domestic water service lines for the new facility served shall be determined in accordance with the National Standard Plumbing Code Fixture Count Method. For design of the waterlines, use maximum Hazen-Williams "C" value of 130 for plastic pipe and 120 for other pipe materials.

##### 1.16.4.1 Water Distribution and Service Lines

a. Flow Requirements

Water shall be supplied by service lines of appropriate capacity to provide the flows determined to be necessary to meet all requirements of the new facility. The requirements for sizing the water lines include all domestic use, and interior and exterior fire protection water, as required.

b. Service Connections

A maximum velocity of 10 feet per second (3.048 meters per second) shall be used for metallic piping and five feet (1.5 meters) per second shall be used for nonmetallic piping. Service connections shall be made via corporation stops, appropriate gooseneck connections, or tapping sleeves and valves. The number and maximum size of corporation stops shall be as specified in the UFGS Section 02510 WATER DISTRIBUTION SYSTEM.

c. Dewatering, Hydrostatic Testing, and Flushing of Lines

The Contractor shall be responsible for implementing the terms and requirements of SECTION 01355 ENVIRONMENT PROTECTION for dewatering, hydrostatic testing, and flushing of lines after disinfection.

d. Domestic Service Stop Valve

Building shall be provided with separate service and stop valves in areas readily accessible to maintenance and emergency personnel.

1.16.4.2 Dedicated Fire Water Service Lines

a. Fire Flow Data

Hydrant flow data shall be conducted by the contractor. Data to be recorded with the flow tests are static pressures, residual pressures, flow rates, pump status, date and time tests were conducted, and name of personnel conducting the fire hydrant flow tests. The static pressures, residual pressures, flow rates, test hydrant and flow hydrants shall be shown on the appropriate contract drawings. Fire hydrant flow tests required for fire protection design shall be made in accordance with the procedures specified in AWWA M17, (Installation, Field Testing, and Maintenance of Fire Hydrants). The Contractor shall coordinate with the McConnell Air Force Base Fire Department and BCE prior to conducting such tests. The Contractor shall submit verification of fire hydrant flow test data provided with the design calculations.

b. Fire Hydrants

The Contractor shall be required to install fire hydrants for the new facilities. One fire hydrant shall be located within a minimum of 150 feet (45 m) of the building fire department connection. All other hydrants shall be located in accordance with Military Handbook MH 1008C. Fire hydrant styles shall meet the installation requirements.

c. Dedicated Fire Line

The Contractor shall be required to provide a separate fire water service line to the building for interior fire sprinkler protection in accordance with NFPA 24, and Military Handbook (MH) 1008C. The fire water service line to the building shall be equipped with a Post Indicator Valve (PIV) that

can be readily located by the fire department. The PIV shall not be placed closer than 40 feet (12 m) to the building it is serving and shall be provided with a tamper switch connected to the building fire control panel. The PIV shall be protected by base standard pipe bollards, filled with concrete, painted and spaced in accordance with installation requirements.

#### 1.16.5 WASTEWATER

Wastewater lines shall be designed and constructed in accordance with the combination of the State of Kansas, Dept. of Health and Environment, "*Design Criteria Considered in Review of Wastewater Treatment Facilities, Policy 96-1*" and the Corps of Engineers Guide Specifications, Technical Manuals (TM), Engineering Manuals (EM), Military Handbooks (MH), and the industry standards listed herein. In the event of conflict, the Contractor shall follow the Local or State requirements/criteria (whichever are more stringent) which govern the wastewater lines.

##### 1.16.5.1 Design Criteria

In addition to the State and Local criteria listed above, the sewage system shall be designed in accordance with TM 5-814-1, TM 5-814-2, and UFGS Guide Specification Section 02531 SANITARY SEWERS. The Contractor shall field verify the location of the existing sanitary sewer system, the sanitary sewer system capacity and invert elevations to ensure that it is adequate for the flows generated by the new facilities. No interruption of service shall be allowed on the existing sanitary sewer line. The Contractor shall coordinate the sequencing of construction as it affects the existing sanitary sewer line with the Contracting Officer. Exterior building sanitary sewer service lines shall be 6 inch minimum diameter. All design slopes will be calculated using the Manning formula. The Contractor shall provide all calculations.

##### 1.16.5.2 Manholes

Manholes are required at all changes of direction, slope, and size. Manholes shall be spaced not more than 300 feet apart. Avoid placing manholes where the tops will be submerged or subject to surface water inflow. Where the invert of the inlet pipe would be more than 18 inches above the manhole floor, a drop connection will be provided. The Contractor shall provide all calculations.

##### 1.16.6 Sewer Mains

The peak diurnal and extreme peak flowrates shall be calculated according to TM 5-814-1. Curved sewers are prohibited. Pipes shall be designed to provide a minimum velocity of two feet per second at the average hourly flowrate, and a minimum velocity of 2.5 to 3.3 feet per second at the peak diurnal flowrate. Maximum velocity shall be 10 feet per second.

##### 1.16.7 Exterior Gas Distribution

This Section contains instructions and engineering requirements relating to the design of the new exterior natural gas distribution system where required, including the building gas service lines and gas service regulator and meter assemblies. The line to the building shall be sized by the Contractor (see minimum service line sizing paragraph Service Line Sizing). The gas distribution systems shall be designed in accordance with NFPA-54, and shall meet the requirements of UFGS Section 02556A GAS DISTRIBUTION. See SECTION 01016, MECHANICAL REQUIREMENTS for additional

information and requirements.

#### 1.16.7.1 Service Line Pressure

Natural gas shall be distributed to the building at about 0.4 psi. The designer shall verify the actual gas pressure in the existing gas main.

#### 1.16.7.2 Manholes or Valve Boxes

All manholes, or valve boxes of any nature within the project that do not conform to the new finish grade in either surfaced or unsurfaced areas shall be adjusted to the new finish grade. Where manholes, or valve boxes fall within a surfaced or unpaved roadway or parking, the existing frames and cover shall be removed and replaced with a heavy-duty frame and cover. The structure shall be adjusted as needed to fit the new conditions. All structures shall be of a type suitable for the intended use and shall conform to the requirements of the applicable section of these specifications.

#### 1.16.7.3 Service Line Sizing

The size of the service lines shall be sufficient to supply the demand without excessive pressure drop and shall not be less than one inch in size.

#### 1.16.7.4 Service Line Materials

All new service lines shall be underground and shall be polyethylene. All aboveground lines at the meter set assembly shall be steel as specified in UFGS Section 15190A, GAS PIPING SYSTEMS and Section 01016, MECHANICAL REQUIREMENTS.

#### 1.16.7.5 Cathodic Protection

Cathodic protection shall be provided for all underground metallic piping and fittings except cast iron. Design of cathodic protection system shall in accordance with Section 01017 ELECTRICAL REQUIREMENTS, paragraph entitled "Cathodic Protection".

#### 1.16.7.6 Gas Meters

A new gas meter shall be provided as part of the new service regulator assemblies. Meters shall be provided with a direct non-resettable, digital readout. Meters shall have a pulse switch initiator capable pulse output of operating up to speeds of 500 pulses per minute with no false pulses and shall require no field adjustments or 4-20 mA output. Initiators shall provide the maximum number of pulses up to 500 per minute that is obtainable from the manufacturer. It shall provide not less than one pulse per 100 cubic feet (2.8 cubic meter) of gas. Meters shall be connected to the EMCS.

### 1.17 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

#### 1.17.1 Trenches

A trenchless excavation method shall be required when an underground utility line crosses any roadway. Sewer and water lines, mains or laterals, shall be placed in separate trenches. The separate trenches shall maintain a minimum horizontal separation of 10 feet and the bottom of the water line shall be at least 18 inches above the top of the sewer.

Sewers crossing above potable water lines shall maintain a vertical separation of 18 inches and must be constructed of suitable pressure pipe or fully encased in concrete for a distance of 3 m on each side of the crossing.

The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Bedding and initial backfill material shall be in accordance with the manufacturer's recommendations. Where no manufacturer's installation manual is available, trench walls shall be excavated to a stable angle of repose as required to properly complete the work. Trench excavations shall adhere to requirements prescribed in EM 385-1-1, September 1996, Safety and Health Requirements Manual. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. Excavation, trenching, and backfilling shall be performed in accordance with the UFGS Section 02316A EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES SYSTEMS.

#### 1.18 Oil Water Separators

Existing Oil Water Separators (OWS) are at capacity. New OWS must be provided by the contractor for work covered in this contract. OWS are required for the military fuel station and for the Refueler Maintenance Facility. Effluent quality shall meet the KDHE standard. Design, size, location are contractor responsibilities. OWS shall have an alarm sounding when the oil volume reaches the alarm quantity. Trench drains connected to OWS and thence to Sanitary Sewers are required at the Refueler Maintenance Facility and Military Fuel Station. Size, configuration, maintenance methods are the responsibility of the contractor. Ventilation of gasoline fumes and ease of cleaning are required features.

#### 1.19 Termite Treatment

Termite Treatment shall be required for all buildings without chloropyrifos as an active ingredient (shall be equal to Demon TC).

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES  
APPENDIX  
PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**

The following photographs were taken 28 May 2003 at the project locations for base and contract option for the Corrosion Control Project.



**B990  
SOUTHWEST CORNER  
LANDSCAPING TO RETAINED BY USAF  
SHALL BE BE REMOVED PRIOR TO TURNOVER TO CONTRACTOR**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**B990  
FUEL TANK  
TO BE RELOCATED**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**B990  
GENERATOR  
TO BE RELOCATED**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**B990  
GENERATOR SHED  
TO BE RELOCATED**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**B990  
PROTECT COURTS AND PAVILION BEYOND PROJECT LIMITS**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**B981  
REMOVE GUARD SHACK  
VIEW FROM EAST**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**B981  
VIEW FROM NORTHEAST  
FENCE REMOVAL,  
SLIDING GATE, MOTOR AND CONTROL RELOCATION  
REMOVE BUILDING, BOLLARDS, ISLAND, FOUNDATION  
REPAIR PAVEMENT**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**B980  
EXISTING REFUELER MAINTENANCE FACILITY  
FRONT VIEW LOOKING NORTH  
PIV**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**B980  
EXISTING REFUELER MAINTENANCE FACILITY  
WEST SIDE**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**B963  
NORTHEAST CORNER  
LANDSCAPING STONES TO REMAIN USAF PROPERTY  
TABLES TO REMAIN USAF PROPERTY**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**SOUTHEAST OF B963  
RELOCATE FENCE AND GATES  
ELECTRICAL EQUIPMENT SHOWN**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**NORTH OF B963  
RELOCATE FENCE AND GATES  
ELECTRICAL EQUIPMENT SHOWN**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**CENTER OF NEW REFUELER MAINTENANCE FACILITY SITE  
LOOKING SOUTHWEST  
SOIL BORING  
B1106 ON BACKGROUND**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**CENTER OF NEW REFUELER MAINTENANCE FACILITY SITE  
ROTATING CLOCKWISE  
LOOKING WEST**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**CENTER OF NEW REFUELER MAINTENANCE FACILITY SITE  
ROTATING CLOCKWISE  
LOOKING WEST  
POL SITE IN BACKGROUND**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**CENTER OF NEW REFUELER MAINTENANCE FACILITY SITE  
ROTATING CLOCKWISE  
LOOKING NORTHWEST  
B963 IN BACKGROUND**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**CENTER OF NEW REFUELER MAINTENANCE FACILITY SITE  
ROTATING CLOCKWISE  
LOOKING NORTH**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**CENTER OF NEW REFUELER MAINTENANCE FACILITY SITE  
ROTATING CLOCKWISE  
LOOKING NORTHEAST  
B946 IN BACKGROUND**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**CENTER OF NEW REFUELER MAINTENANCE FACILITY SITE  
ROTATING CLOCKWISE  
LOOKING EAST  
B950 IN BACKGROUND**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**CENTER OF NEW REFUELER MAINTENANCE FACILITY SITE  
ROTATING CLOCKWISE  
LOOKING SOUTHEAST  
B950 ON LEFT**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**NORTHWEST CORNER OF NEW REFUELER MAINTENANCE FACILITY SITE  
ELECTRICAL**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**B1102 CAS  
LOOKING SOUTHWEST  
3 HVAC UNITS AND DUMPSTER**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**B1102 CAS  
LOOKING SOUTH  
3 HVAC UNITS AND DUMPSTER**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**B1102 CAS  
LOOKING SOUTH  
3 HVAC UNITS AND DUMPSTER**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**TYPICAL MOW STRIP  
FENCE PVC BLACK COATING**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**TYPICAL BOLLARDS  
NW CORNER OF THE NEW RMF SITE**

**CORROSION CONTROL MCCONNELL AFB  
APPENDIX PHOTOGRAPHS  
SITE WORK/CIVIL/UTILITIES**



**MONITORING WELL #3  
NORTH – NEW RMF SITE**

## SECTION 01013

ARCHITECTURAL BUILDING REQUIREMENTS  
[04/03]

## PART 1 GENERAL

## 1.1 REFERENCES

The codes and referenced design publications listed below shall be used as sources of criteria for the architectural design. The most current edition of the code or standard shall be used as criteria for the design unless supplied with a date as listed here. The criteria from these sources may be supplemented but not supplanted, by applicable criteria contained in nationally recognized codes and standards.

## DEPARTMENT OF THE ARMY

TI-800-1	Design Criteria
TM 5-803-5	(Mar 81) Installation Design Guide (Ref: AFM 88-43)
Design Guide	Architectural Compatibility Guide, McConnell AFB, Wichita, Kansas, 1994

## BRICK INSTITUTE OF AMERICA

Tech Note 28B	Brick Veneer / Steel Stud Walls Nov. 1999
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## DEPARTMENT OF DEFENSE

DoD-Standard	(Jan 2002) Department of Defense Antiterrorism Standards for buildings
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## Federal Standards (FED STD)

FED STD 795	(April 1988) Uniform Federal Accessibility Standards, Available at <a href="http://www.access-board.gov">www.access-board.gov</a>
ADAAG	(January 1998) ADA Accessibility Guidelines for Buildings and Facilities, Available at <a href="http://www.access-board.gov">www.access-board.gov</a>
OSHA	Occupational Safety and Health Standards

## INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS

UBC-1997	International Building Code, 2000
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## NATIONAL FIRE PROTECTION ASSOCIATION

NFPA-101	Life Safety Code, 2000
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## 1.2 GENERAL

The architectural portion of the base bid will provide a new Refueler Maintenance Facility (RMF), POL Operations Center (POLOPS), and Military Fuel Station. Architectural bid options include construction of a canopy for the Military Fuel Station and construction of an inspection bay for the Refueler Maintenance Facility.

The following spaces will be provided within the POL Operation Center: Vestibules, Interior Circulation, Classroom, Laboratory, Lab Office, Ready Room, Control Room, Mechanical/Electrical Room, Communications Room, Janitor's Closet, Break Room, Men's and Women's Toilets (including Locker areas), and Offices.

The following spaces will be provided within the Refueler Maintenance Facility: Vestibule, Offices, Interior Circulation, Mechanical/ Electrical Room, Communications Room, Storage (Bid Alternate only), Men's and Women's Toilets, Men's and Women's Clean Rooms, Tool Room, Wash Bay Equipment (Bid Alternate only), Work Bays and an Inspection Bay (Bid Alternate only).

The canopy for the proposed Military Fuel Pumps will measure 44'-0" x 52'-0" minimum. Clearance height from pavement to the underside of the canopy will be 16'-0".

The attached floor plans and elevations are conceptual and require refinement. However, adjustments by the contractor's design agent to accommodate building equipment, structural components, etc., must be approved by the Contracting Officer.

The attached floor plan for the POL Operations Center contains 4,300 GSF. The Refueler Maintenance Facility floorplan contains 5,601 GSF (base bid), or 6,861 GSF with the optional Wash Bay. These gross square footages may be increased, but not reduced.

Columns will not be allowed within any of the room spaces as laid out on the enclosed floor plans, unless otherwise shown on the drawings. Pilasters and in-wall columns which protrude into the room spaces and interfere with activities and or furniture placement are not acceptable.

### 1.3 DESIRED IMAGE AND ARCHITECTURAL COMPATIBILITY

The contractor will verify all existing conditions and dimensions during design and prior to construction.

The building will fit the site and be compatible with the surrounding environment and be in full compliance with the base Architectural Compatibility Guide. Building elevations will be similar in appearance to the attached drawings.

The POL Operations Center and Refueler Maintenance Facility are single story buildings with hipped roof structures. Entrance canopies will also be hipped roof structures as indicated in the attached building elevations. Additionally, the Military Fuel Pump canopy will be a hipped roof structure.

Interior materials and finishes will comply with the requirements specified in Interior Finish Schedules on the attached plans and Section 01014 Interior Design Requirements.

### 1.4 DESIGN CRITERIA

The technical sections provided will serve as the minimum design standards established for this project. Design publications listed in each section shall be used as sources of criteria for design. The criteria from these sources may be supplemented, but not supplanted, by applicable criteria contained in nationally recognized codes, standards, and specifications. The basic US Army Corps of Engineers design guidance is contained in TI-800-1, Design Criteria, TM 5-803-5, Installation Design, and the Design Guide, Installation Design Guide, McConnell AFB.

#### 1.4.1 Fire Safety

The initial basis for determination of building structure type and building area is the UFC 3-600-01. This will direct the designer to the appropriate area of the UBC-1997 and NFPA-101. Fire separation walls and egress from the facilities will meet or exceed the requirements of NFPA-101. Also see Section 01018 FIRE PROTECTION REQUIREMENTS of this document. The POL Operations Center and Refueler Maintenance Facility will be completely fire sprinklered as part of the requirement.

#### 1.4.2 Occupational Safety and Health

Building design will comply with OSHA, Occupational Safety and Health Standards criteria for all items which must be included in the design to ensure safety compliance.

#### 1.4.3 Handicapped Accessibility

The POL Operations Center and Refueler Maintenance Facility will be in compliance with the requirements of the Uniform Federal Accessibility Standards (UFAS), FED STD 795 and Americans with Disabilities Act, ADAAG. In situations where conflicts exist between UFAS and ADA requirements, the more stringent requirement will govern.

### 1.5 TECHNICAL SPECIFICATIONS

The government provided technical specifications, Unified Facilities Guide Specifications (UFGS) are available at the website identified in Section 01331, SUBMITTALS DURING DESIGN. These specifications will be completely edited by the contractor's design agent and fully coordinated with the drawings to accurately and clearly identify the products used in construction and their installation requirements.

The provided specifications define the minimum requirements and level of quality for items of equipment, materials, installation, and testing that will be provided for the facility. Where items of equipment, materials, installation, or testing requirements are not covered in the provided specifications, the contractor's design agent will prepare new specification sections addressing the requirements, or further elaborate such requirements within existing guide specification sections.

### 1.6 TYPE AND METHOD OF CONSTRUCTION

#### 1.6.1 Facility Construction

This facility will be designed as permanent construction. The definition of permanent construction per MIL HDBK 1190; "Buildings and facilities designed and constructed to serve a life expectancy of more than 25 years, should be energy efficient, and must have finishes, materials, and systems

selected for low maintenance and low life-cycle cost".

#### 1.6.2 Exterior Walls and Finish Materials

Exterior walls and finish materials will be selected on the basis of architectural compatibility and appearance in accordance with the design provided. The outside face of the exterior walls will be composed of face brick and exterior insulation and finish system (EFIS). Exterior walls will have a minimum insulation of R19 based on aged insulation values for the opaque portion of the exterior wall construction. If steel stud backup is used in the exterior wall construction, the insulating value of the insulation material between studs must be de-rated in accordance with ASRAE 90.1 table 8C-2. Exterior foundation walls shall have 2" of Polyurethane Type II perimeter insulation from the top of the footing to the underside of the floor slab. In addition, brick veneer and steel stud back up shall be designed in accordance with the Brick Institute's Tech Note 28B.

All interior cavity thru-wall flashing shall be a metal type.

#### 1.6.3 Interior Wall Construction

All interior walls will be permanent noncombustible construction. Steel studs when used will be sized according to the wall heights. Framing shall be spaced at a maximum of 16" on center. The contractor will design the partition framing and furring system to be capable of carrying a transverse load of 5 PSF without exceeding either the allowable stress or a deflection of L/240.

Interior walls requiring fire ratings will be designed and constructed in accordance with an UL tested system. Fire rated walls will be continuous from the floor to the structural roof deck above. These walls will allow for structural deflection of the roof structure.

#### 1.6.4 Floors

The Refueler Maintenance Facility will have a minimum 10 inch thick reinforced concrete floor slab with hardened non-slip surface in the work and inspection bay areas, placed on granular base and engineered fill materials recommended by the Offeror's geotechnical engineer. Other areas of the Refueler Maintenance Facility, and the POL Operations Facility, will have concrete slabs, granular base and engineered fill materials placed in accordance with the geotechnical engineer's recommendations. All interior slabs will be consistent in thickness in any one room. Floors containing floor drains will be constructed to slope to the drains.

Interior stairs providing access to/from the Refueler Maintenance Facility work/inspection bays and administrative area will have steel nosings and safety strips.

The floor slab in the POL Operations Center Laboratory will be depressed 6" as indicated in the attached plans. Steps to/from the depressed will be provided as indicated.

Finish floor materials will be provided in accordance with the Material Finish Schedules and Section 01014, Interior Design Requirements.

### 1.7 EQUIPMENT AND FURNISHINGS

#### 1.7.1 Contractor Furnished and Installed Equipment

Contractor Furnished and Contractor Installed equipment within these facilities will include, but not be limited to the following:

POL Operations Center:

- Toilet Accessories and Partitions
- Built-in benches
- Fire extinguisher cabinets (2) & extinguishers (1)
- Plastic laminate surfaced casework
- Metal laboratory casework
- Two compartment sink w/high rise faucet
- Exhaust hood
- Vacuum Pump
- Emergency shower and eye wash station
- Utility sink
- Garbage disposal
- Double bowl SS sink w/faucet & spray attachment (Break Room)
- Large single bowl SS sink w/ high rise faucet (Laboratory)
- Shelving and mop rack in Janitor's Closets
- Drinking fountains, including (1) ADA compliant
- Slide-in electric range
- Range hood w/fire suppression system
- Double tier metal lockers w/canted tops
- Wall or ceiling mounted T.V. monitor brackets
- Key storage cabinet

Refueler Maintenance Facility:

- Toilet Accessories and Partitions
- Built-in benches
- Fire extinguisher cabinets & extinguishers
- Emergency shower and eye wash stations
- Utility/shop sink w/spray attachment
- Waste oil collection system
- Fully recessed 75,000 lb. hydraulic lift and related equipment
- Overhead crane rail rated for 2 ton capacity
- Electric overhead door openers
- Drinking fountains, including (1) ADA compliant
- Air Compressor and related equipment
- Vehicle wash system
- Double tier metal lockers with canted tops
- Key storage cabinet

Military Fuel Pumps and Canopy (Bid Alternate):

- Dual nozzle fuel pumps
- Automatic pump control system
- Fire extinguisher cabinet & extinguisher

1.7.2 Government-Furnished, Contractor Removed/Reinstalled Equipment

The government will provide equipment indicated below. The contractor shall remove, transport and install this equipment in the POL Operations Center:

- Full-size refrigerator
- Dishwasher
- Water filtration system for dishwasher

Fire extinguisher and fire blanket  
Laboratory warning signage

## 1.8 SOUND AND VIBRATION CONTROL

### 1.8.1 Wall Construction

Construction methods, materials, and finish materials shall be selected to impede transmission of the human voice and equipment vibrations. Noise generating equipment and activity centers will be isolated through conventional methods where possible. Utilization of equipment isolators, construction of full height walls, stud staggering, and offsetting of receptacles and other wall penetrations will be used to limit sound transmission. All interior walls will extend up to the underside of structural deck. Walls surrounding an office, classroom, control room, break area, etc will be full height with sound attenuation insulation batts, with a minimum sound transmission class (STC) of 50.

### 1.8.2 Sound Absorption

Installation of sound absorption materials and other techniques will be used throughout the facility to reduce noise reverberation.

## 1.9 PHYSICAL SECURITY

Conventional security measures, such as: door locking hardware, will be incorporated into the facility design and development. See specific paragraphs in this section for additional security criteria.

## 1.10 ECONOMY AND VALUE OF BUILDING CONSTRUCTION

### 1.10.1 Economy

All materials will be readily available within the local area, as shall sufficient trades to construct the building. Special or unique forms of construction should avoided, where skilled workers within the local area are not readily available.

### 1.10.2 Operations and Maintenance

Material selections will be based upon reducing operation and maintenance costs. All materials will be easy to clean and resist soiling. No material on the exterior of the building shall require field painting, except hollow metal doors and frames.

### 1.10.3 Life Cycle Cost

Material selection shall be based upon overall Life Cycle Cost to the Government.

## 1.11 TECHNICAL REQUIREMENTS

### 1.11.1 Exterior walls

The primary finish material for the exterior walls shall be face brick and Exterior Insulation and Finish System (EFIS).

### 1.11.2 Miscellaneous Metals

#### 1.11.2.1 Access Doors and Panels

Access doors and panels shall be flush type. Frames for access doors will be fabricated of not lighter than 16 gauge steel with welded joints and finished with anchorage for securing into construction. Access doors will be a minimum of 14" by 20" and of not lighter than 14 gauge steel, with stiffened edges, complete with attachments. Access doors will be hinged to frame and provided with a flush face and a keyed operated latch. Exposed metal surfaces will have a shop applied prime coat. Finished paint coat will match surrounding surfaces. Panel will be installed in uninhabitable rooms (i.e., closets) and/or non-conspicuous locations.

#### 1.11.2.2 Louvers

Location and sizing of louvers in the exterior walls will be consistent with the attached building elevations. Louvers shall be aluminum with dark bronze anodized finish. Force protection issues require that all intake air for the HVAC system be brought into the building 10'-0" above grade. See mechanical requirements Section 01016. Recommended louver locations are indicated on the attached building elevations.

#### 1.11.3 Roof Design

##### 1.11.3.1 Structural Standing Seam Metal Roofing

All proposed structures will have a 13" or 19" Structural Standing Seam Metal roof, polyvinylidene fluoride (Kynar 500). Color will be federal specification 595b, No. X3617. The standing seam roofing will meet the requirements of specification section 07416, Structural Standing Seam Metal Roofing. The roof will also meet the load, deflection and uplift requirements of the criteria listed in section 01015.

##### 1.11.3.2 Military Fuel Pump Canopy (Bid Alternate)

A hipped roof canopy measuring approximately 44'-0" by 52'-0" (minimum) will be located as indicated on the attached site plan. This canopy will be steel framed with structural standing seam metal roofing. The canopy will meet the load, deflection and uplift requirements of the criteria listed in section 01015. The canopy columns will have brick veneer and EFIS enclosures as indicated on the attached elevations. The underside of the canopy will be covered with a factory finished aluminum or steel soffit to prevent birds from nesting in steel framework. Lighting will be provided in the soffit of the canopy.

##### 1.11.3.3 Roof Insulation

Roofing insulation will be a polyisocyanurate type. A minimum aged "R" value of the roofing insulation will be R30, based upon a maximum R-5.56 per 1" of thickness. Therefore, the total roofing insulation thickness will be a minimum 6".

A single ply vapor barrier will be installed between the roofing deck and the bottom of the roofing insulation. The thickness of the vapor barrier will be in accordance with the roofing system standard thickness.

##### 1.11.4 Sheet Metalwork, General

Contractor will include a quality assurance plan which includes a checklist of points to be observed, prior to start of roofing work.

Fascia shall have "V" crimps and a stable substrate as required to prevent "oil-canning" effect. Finish will be dark bronze anodized.

#### 1.11.5 Windows

##### 1.11.5.1 Exterior Windows

Exterior windows will have aluminum thermal break frames and insulated glazing as specified in UFGS Section 08810 GLASS & GLAZING. Windows will be deep set with a dark bronze anodized finish. Glazing will be medium bronze tint. Exposed trim will be dark bronze anodized aluminum. Window installation must meet the following DoD-Standard Antiterrorism force protection requirements: To ensure that the full strength of the laminated glazing is engaged, frames, mullions, and window hardware will be designed to resist a static load of 1 lb per square in applied to the surface of the glazing. Frame and mullion deformations will not exceed 1/160 of the unsupported member lengths. The glazing will have a minimum frame bite of 3/8" for structural glazed window systems and 1" for window systems that are not structurally glazed. Frame connections to surrounding walls will be designed to resist a combined loading consisting of a tension force of 200 lbs/in and a shear force of 75 lbs/in. Alternatively, use frames that provide an equivalent level of performance.

##### 1.11.5.2 Interior Windows

Windows located in the interior walls of the POL Operations Center and Refueler Maintenance Facility will be hollow metal frames. These windows will have tempered, laminated glazing as specified in UFGS Section 08810 GLASS & GLAZING. Window frames will be painted to match the door frames. Pass-through window units in the POL Operations Center Laboratory and Control Center will be a two lite slider type and measure approximately 3'-6" x 4'-0". Window units in the Refueler Maintenance Facility Offices will be fixed type measuring approximately 4'-0" x 6'-0". The top of the interior windows will match the top of the interior door frames.

#### 1.11.6 Doors

##### 1.11.6.1 Exterior Doors

Exterior personnel doors will be insulated, heavy duty level 3, flush hollow metal doors in accordance with specification section 08110, Steel Doors and Frames, except the main entrance doors, Laboratory exterior door, Break room exterior door, Work Bay exterior doors (2), and Inspection Bay exterior door. These doors will be aluminum storefront in accordance with Specification 08120, Aluminum Doors and Frames. Exterior doors and glazing will meet the same force protection requirements as exterior windows. Exterior H.M. doors and frames will be painted to match the dark bronze anodized finish specified for aluminum windows. Exterior aluminum doors will be dark bronze anodized finish.

##### 1.11.6.2 Interior Doors

Interior doors for the POL Operations Center will be solid core wood in accordance with specification section 08210, Wood Doors. Frames for wood doors will be hollow metal. Interior doors for the Refueler Maintenance Facility will be flush solid core metal in accordance with section 08110,

Steel Doors and Frames.

1.11.7 Hardware; Builder's (General Purpose)

1.11.7.1 Locks and Latchsets

All doors will be lockable, except toilets, locker areas and interior vestibule doors. All keyed locks will have removable lock cylinders. All doors shall have lever handles.

1.11.7.2 Lock Cylinders

Provide Corbin cylinders, 7 pin, Kaba Peak keyway to match the existing McConnell AFB grandmaster. Each lock will be provided with 4 change keys

1.11.7.3 Lock Trim

The doors of these facilities will have lever handles. All exterior doors will have panic type hardware, except doors from mechanical/ electrical and communications rooms.

1.11.8 Keying

Locks and special key hardware will be keyed to the McConnell AFB master key system. The contractor will provide construction cores. The Contractor will meet with the Contracting Officer's Representative and the Base Locksmith prior to developing the keying schedule. A grand master keying system will be provided for each building. All of the keys will be keyed in one series, except the mechanical/electrical and communication equipment rooms. Locks for all mechanical/electrical, and communications equipment rooms will be keyed to the existing Base utility keying system.

1.11.9 Auxiliary Hardware

All exterior doors will have aluminum housed type weather seals. All fire rated doors will have compression type seal gasketing.

1.11.10 Finishes

Door hardware finish will match satin stainless steel Type 630.

1.11.11 Door Hardware

1.11.11.1 Hardware Requirements

Door hardware in fire-rated walls will comply with NFPA and other applicable criteria.

1.11.11.2 Hardware Sets

The following hardware sets listed are the minimum functional hardware requirements for each door types. The contractor's design agent will review these requirements and determine if additional hardware is necessary prior to construction.

a. Exterior Steel Doors

(1) All single exterior personnel doors except communications rooms will have the following hardware features:

1-1/2 Pr Grade 1 hinges  
Exit Device  
Lockset  
Overhead closer  
Wall or floor Stops  
Weatherstripping  
Rain drips  
Threshold  
Kickplate  
Silencers

(2) All double exterior doors except mechanical/electrical rooms will have the following hardware features:

3 Pr Grade 1 hinges  
Surface vertical rod exit devices  
Lockset  
Overhead closer (Both leafs)  
Wall or Floor stops  
Kick plate  
Weatherstripping  
Rain drips  
Threshold  
Silencers

(3) All Communications room doors will have the following hardware features:

1-1/2 Pr Grade 1 hinges  
Lockset  
Overhead holder (grade 1)  
Kickplate  
Weatherstripping  
Rain drips  
Threshold  
Silencers

(4) All double exterior mechanical room/electrical room doors will have the following hardware features:

3 Pr Grade 1 hinges  
Lockset (active leaf)  
Overhead holder both leaves (grade 1)  
2 Lever extension flush bolts(grade 1) (inactive leaf)  
Kickplate  
Weatherstripping  
Astragal  
Rain drips  
Threshold  
Silencers

b. Interior Doors

(1)All single doors, except where specified otherwise, will have the following hardware features:

1-1/2 Pr Grade 1 hinges  
Lockset  
Overhead closer

Wall or floor stops  
Silencers

(2)POL Operation Center Control Room door will have the following hardware features:

1-1/2 Pr Grade 1 hinges  
Cypher lock (Simplex Unican Series 1000, model 1021C or equal)  
Overhead closer  
Wall stop  
Silencers

(3)Restroom and locker/clean room doors (excluding fire rated partitions) will have the following hardware features:

1-1/2 Pr Grade 1 hinges  
Push Plate  
Pull with Plate  
Overhead closer  
Wall or floor stops  
Kick plate  
Silencers

(4)Restroom doors in fire rated partitions will have the following hardware features:

1-1/2 Pr Grade 1 hinges  
Latchset (hositality, push/pull)  
Overhead closer  
Wall or floor stops  
Kick plate  
Silencers

(5)Doors separating the Refueler Maintenance Facility work bay and inspection bay areas from the administrative areas will have the following hardware features:

1-1/2 Pr Grade 1 hinges  
Exit Device  
Lockset  
Overhead closer  
Wall stops  
Weatherstripping  
Threshold  
Kickplate

(5) Double interior personnel doors at the Refueler Maintenance Tool Room room will have the following hardware:

Grade 1 hinges  
Push Plate  
Pull with Plate  
Overhead holder both leaves (grade 1)  
Weatherstripping  
Overhead closer (both leafs)  
Kick plates

(6) Double or single interior personnel doors to vestibules will have the following hardware:

Grade 1 hinges  
 Push Pull bars on both sides  
 Overhead closer(s) (Both leafs if double door)  
 Wall or Floor stops  
 Kick plates

#### 1.11.12 Key Storage System

A recessed wall mounted key cabinet will be provided in Office 113 (POL Operations Center) and Office 108 (Refueler Maintenance Facility). The key cabinet will contain all additional keys for all areas of the applicable building. Cabinet will have the capacity to store a minimum of two keys for each room on an individual key hook. Key hooks will be mounted on panels with sufficient distance between hooks that will allow easy identification and removal. Cabinet key panels will be readily removable and capable to insert additional panels for expansion needs. Key cabinet will have key locking capabilities. Cabinet door will be a full height piano hinge.

#### 1.11.13 Gypsum Wallboard

Predecorated gypsum board is not considered acceptable.  
 Exterior gypsum soffit board is not considered acceptable.

#### 1.11.14 Exterior Signage

##### 1.11.14.1 Unit Identification Signage

Exterior unit identification signage will be provided in accordance with details contained in the plans, and shall be mounted on an exterior wall surface at a location determined by Contracting Officer. Exterior signage shall be of the size and type as shown on the drawings and/or as detailed and described herein. Signage shall be complete with lettering, reflective backing material, fasteners, brackets, and associated components for a complete installation. Materials and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of facility signage. Letters shall be installed flush against the wall surface without use of extender sleeves.

Individual letters shall be fabricated from solid acrylic and shall be 12-inches in height. Text shall be all upper case (all capitals) Helvetica Medium, except for use of lower-case for the small "nd" in 22d with the bottom of all letters flush along baseline. Individual letters shall have a depth of 1-inch. The messages shall read as follows:

Sign One:  
 22nd LRS POL

Sign Two:  
 22nd LRS REFUELING MAINTENANCE

Note: The contractor must verify this information with the Base Civil Engineer prior to fabrication

Threaded studs, of number and size as recommended by manufacturer, shall be secured in quick-setting mortar or sealant for concealed anchorage. Letters shall be mounted with mounting studs and be flush with building surface. Templates for mounting shall be supplied.

### 1.12.2 Real Property Building Number Signs

The POL Operations Center, Refueler Maintenance Facility and Military Fuel Station will receive a Real Property Facility Number Sign (AFP 32-1097 Type B5 Building Number Sign). These signs shall consist of white reflective numbers on brown reflective sheeting adhered to aluminum blanks (8-inches in height, 16-inches in width) utilizing 4-inch high Helvetica Medium numbers and fastened directly to wall surface with exposed fasteners (fastener heads painted after installation). Sleeves shall be utilized on Exterior Finish and Insulation System (EIFS) with fasteners embedded into solid substrate. The sign(s) shall be installed at locations as directed by the Contracting Officer. The numbers for the new facilities are as follows:

POL Operations Center -	955
Refueler Maintenance Facility -	952
Military Fuel Station -	953

### 1.11.15 Fire Extinguisher Cabinets

Fire extinguisher cabinets will be fully recessed type with a flat metal door. Clear plastic bubble type door fronts are not acceptable. Fire extinguisher cabinets will be located in accordance with NFPA Life Safety Code #101. Color of the cabinets will match that of the wall.

### 1.13.1 Fire Extinguishers

Fire extinguishers will be provided in all fire extinguisher cabinets. Extinguishers will be 10lb, ABC type in all locations except mechanical rooms. Mechanical rooms will receive 10 lb, BC type. The contractor's design agent will verify this information with the base fire department prior to design.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

## SECTION 01014

## INTERIOR DESIGN REQUIREMENTS

## 01/02

## PART 1 GENERAL

## 1.1 COMPREHENSIVE INTERIOR DESIGN

Comprehensive Interior Design (CID) Requirements include designing, selecting and developing interior building materials, finishes, special effects and furnishings for an integrated visual design theme (architectural and interior design) which reflects the interior atmosphere desired by the user. CID requirements, therefore, include building-related interior design and furniture-related interior design as defined in ER 1110-345-122. Both parts of the CID package shall be developed concurrently with the design of the facility and be submitted for review with the drawing contract submittal. Submittal requirements and format shall be as described in Sections 01019, 01020, and 01021.

## 1.1.1 Building-Related Interior Design Requirements

Room and area interior finishes and wall substrate types shall be as shown on the Interior Room Finish Schedule in the government drawings unless otherwise noted in this specification section.

## 1.1.1.1 Interior Color Scheme

Prior to any submittals of interior finish color schemes, the contractor's design agent (interior designer) shall meet with the COR, HQ AMC interior designer, and McConnell AFB personnel to develop an accepted general direction and basis for preliminary color schemes for the project. The accepted colors shall be reflected in all subsequent submittals.

## 1.1.1.2 Contractor Supplied Materials and Equipment

Contractor supplied finish materials and equipment shall meet the physical and performance criteria requirements listed in the outline specifications and edited technical specifications. Unless otherwise noted, all finish materials, equipment, and other items described herein shall be considered contractor supplied and installed.

## 1.1.1.3 Corner Guards

All outside corners within the facility, with the exception of ceramic tiled walls, shall be protected by surface mounted corner guards which shall extend from the top of the wall base to the finished ceiling. Profile shall be radiused (bullnosed) to reduce injuries. Reference specification Section 10000, DIVISION 10: SPECIALTIES (paragraph 1.4 SECTION 10260A, WALL PROTECTION).

## 1.1.1.4 Wall Mounted Items

All equipment, toilet accessories, visual communication specialties, shelving, chair rails, and other items to be wall mounted shall be affixed to the wall structure and supplemental structural support shall be provided sufficient to provide a firm, sound installation in accordance with manufacturer's recommendations based on the weight of the item and any

withstanding force or additional weight it is designed to support.

#### 1.1.1.5 Exposed Structural Ceilings

All rooms with exposed open structure for ceilings shall have all ceiling components painted to include all structural elements, piping, conduit, ductwork, and vents to present a monolithic appearance.

#### 1.1.1.6 Interior Signage

A complete system of interior signage shall be provided for room identification. Signage shall meet all ADA requirements for accessibility and all requirements provided in specification Section 10000, DIVISION 10 SPECIALTIES (paragraph 1.6 SECTION 10440A, INTERIOR SIGNAGE).

#### 1.1.2 Furniture-Related Interior Design Requirements

Prior to any submittals for interior furniture and equipment, the contractor's design agent (interior designer) shall meet with the COR, HQ AMC interior designer, and McConnell AFB personnel to develop an accepted general direction and basis for minimum quality standards, recommended sources, type, and quantity for each item required. Procurement and installation of "freestanding" furniture and accessories shall be considered "Not In Contract" (N.I.C.) with respect to this contract. Systems (pre-wired workstations) furniture shall be considered an option to the construction contract.

##### 1.1.2.1 Systems Furniture Requirements

Systems furniture shall be supplied to configurations and component requirements as shown on the Government drawings and as specified in the Government edited technical specification Section 12705, SYSTEMS FURNITURE.

Systems furniture shall be a panel-based type. A desk chair for each workstation shall be considered a workstation component. Other major components for each workstation configuration shall include, but not limited to, panels, worksurfaces, storage pedestals, storage kiosks, 2-drawer undercounter lateral files, open shelving, flipper door storage bins, wire management, keyboard tray with mousepad, and undershelf task lighting.

##### 1.1.2.2 Freestanding Furniture and Accessories

Freestanding furniture and accessory requirements shall include, but are not limited to, the following:

- a. Storage and File Cabinets.
- b. Dry Erase/Bulletin Boards.
- c. Seating.
- d. Tables.
- e. Artwork.

##### 1.1.2.3 Sources

Sources shall be primarily taken from General Services Administration (GSA) Authorized Federal Supply Schedules. The contractor shall be responsible

for possessing or developing a comprehensive GSA catalog resource library from which to make selections. UNICOR (Federal Prison Industries) furniture sources may be considered, but are no longer a mandatory source, for furniture requirements.

PART 2 SPECIFIC REQUIREMENTS

2.1 ROOM REQUIREMENTS

Individual room requirements regarding finishes, accessories, and equipment are provided on the Government Space Data Sheets which accompany these specifications.

-- End of Section --

SECTION 01015

STRUCTURAL REQUIREMENTS

PART 1 STRUCTURAL

1.1 CODES AND REFERENCE PUBLICATIONS

US ARMY CORPS OF ENGINEERS, KANSAS CITY DISTRICT

SDCC Kansas City District Structural Design  
Controlling Criteria (SECTION 01290)

FEDERAL EMERGENCY MANAGEMENT AGENCY

FEMA 302 NEHRP Recommended Provisions for Seismic  
Regulations for New Buildings and Other  
Structures

U.S. ARMY CORPS OF ENGINEERS TECHNICAL INSTRUCTIONS

TI 809-02 Structural Design Criteria for Buildings  
(Sep 1999)

TI 809-04 Seismic Design For Buildings (Jan 1999)

TI 809-07 Design of Cold-Formed Load Bearing Steel  
Systems and Masonry Veneer/Steel Stud  
Walls (Nov 1998)

UNIFIED FACILITIES CRITERIA

UFC 1-200-01 Design: General Building Requirements  
(July 2002)

UFC 4-010-01 DoD minimum Antiterrorism Standards for  
Buildings (July 2002)

INTERNATIONAL CODE COUNCIL

IBC 2000 International Building Code(2000)

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

AASHTO Standard Specifications for Highway  
Bridges (16th Edition, 1996)

AMERICAN CONCRETE INSTITUTE BUILDING CODE

ACI 318-02 Requirements for Structural Concrete and  
Commentary (ACI 318R-02)

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

AISC "Manual of Steel Construction -Load &  
Resistance Factor Design" (3rd Edition)

AISC Design Guide 3 "Serviceability Design Considerations for Low-Rise Buildings" Pub. No. D803 (3M1092)

STEEL DECK INSTITUTE

SDI Steel Roof Deck Design Manual (Steel Deck Institute Publication, current edition)

STEEL JOIST INSTITUTE

SJI Standard Specification, Load Tables and Weight Tables

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA Low Rise Manual (2001) Low Rise Building Systems Manual

AMERICAN SOCIETY OF CIVIL ENGINEERS STANDARD

ASCE 7-98 ASCE Standard, Minimum Design Loads for Buildings and Other Structures

1.2 PROJECT DESCRIPTION AND REQUIREMENTS

1.2.1 Refueler Maintenance Facility

The Refueler Maintenance Facility (RMF) shall be a single story structure with floor, roof and exterior wall configurations as indicated on the attached architectural drawings. The building shall include a 2-ton overhead crane in the workbay area. A 75k pound hydraulic lift shall be located in one workbay as designated on the architectural drawings. The hydraulic lift shall be recessed below the slab such that the drive-on ramps are flush with the finish floor elevation of the work bay. An inspection bay bid option is included with the RMF as shown on the architectural drawings. As stated in the Architectural section (01013), CMU is to be utilized to a height of 9'-4" above the finish floor elevations for durability concern. The finish floor elevation of the work bays and the inspection (Bid Option) is 18" lower than the remainder of the building. The interior partitions shall be CMU.

1.2.2 POL Operations Center

The POL Operations Center (POLOPS) shall be a single story structure with floor, roof and exterior wall configurations as indicated on the attached architectural drawings.

1.2.3 Canopy

The canopy for the Military Fuel Pumps is a bid option. The canopy shall be configured as indicated on the attached architectural drawings. The canopy shall be steel moment frame system in each principle direction.

1.2.4 Design Requirements

The buildings shall be structurally designed and configured by the Design/Build Contractor in accordance with the criteria and other

requirements stated herein. The structural systems and material to be selected by the Design-build Contractor for the buildings will be suitable for permanent-type construction; capable of carrying the required loads, and compatible with the architectural and functional concepts. In selecting the type of structural system, the total facilities should be considered, since the choice will influence such features as HVAC, architectural lighting, and utility requirements. The Design Build contractor shall give consideration to the availability of labor and materials when selecting the structural materials to be utilized.

1.2.5 Quality Requirements

All structural calculations and drawings shall be checked and initialed as such by a registered engineer other than the original design engineer. Construction Documents (drawings and specifications) shall be signed and sealed by a professional engineer who is registered and currently licensed.

1.3 DESIGN CRITERIA

The structural design shall fully comply with the provisions provided in Section 01290 "Kansas City District Structural Design Controlling Criteria (SDCC)" and with additional requirements and revisions contained herein. In case of conflict between this document (section 01015) and SDCC, section 01015 controls.

1.4 STRUCTURAL LOADING CRITERIA

Structural loading criteria shall be developed using the criteria sources and following the procedures indicated below. The buildings shall be classified as a Category II facility for the purpose of calculating of live, wind and snow loads.

1.4.1 Roof Live Loads

1.4.1.1 Snow Load

Roof snow load, including additional loading due to snow drifting where appropriate, shall be calculated and applied in accordance with ASCE 7-98 using a ground snow load of 20 PSF.

1.4.1.2 Rain on snow Loads

Rain loads shall be considered in accordance with ASCE 7-98.

1.4.1.3 Minimum Roof Live Load

Main Structures: A minimum roof live load of 20 PSF applied in accordance with ASCE 7-98 shall be used as a loading condition for the roof independent of the calculated snow load. This load shall be the minimum load applied and shall not be considered reducible by other codes.

1.4.2 Floor Live Loads

Live loads shall be in accordance with ASCE 7-98 and as follows:

AREA	LIVE LOAD
RMF Working Bay	HS-20/Lane (AASHTO)
RMF Inspection Bay (Bid Option)	HS-20/Lane (AASHTO)

## Canopy

HS-20/Lane (AASHTO)

## 1.4.3 Wind Loads

Wind loads shall be calculated in accordance with the procedures outlined in ASCE 7-98 using Exposure "C" and a Basic Wind Speed (3-Second Gust Speed) of 90 mph. Wind loads for both the main wind-force resisting system and for components and cladding shall be considered.

## 1.4.4 Seismic Loads

All structures shall be designed to withstand seismic loading in accordance with US Army Corps of Engineers TI 809-04. Seismic Parameters for McConnell Air Force Base are as follows:

$S_S$  (Short Period Spectral Response Acceleration) = 0.14  
 $S_1$  (1 Second Period Spectral Response Acceleration) = 0.06  
 Site Classification D.  
 Seismic Use Group I.

## 1.4.5 Dead Loads

Minimum design dead loads for common building materials shall be obtained from ASCE 7-98. Equipment loads and loads for materials not listed in that publication can be obtained from other recognized sources. The calculated roof uniform dead loads include the weight of the roof system, mechanical, Sprinkler system, electrical and architectural items. In addition to the calculated uniform roof dead loads, roof design must also include concentrated loads from mechanical equipments and other miscellaneous items. The calculated total uniform loads for mechanical, electrical and sprinkler system shall not be less than 10 psf. When calculating netuplift loads using ASCE 7-98 load combinations, use 50% of the total uniform loads of mechanical, electrical and sprinkler loads.

## 1.4.6 Collateral Loads

If a Metal building system is selected as the structural system, the minimum collateral loads assumed shall be 10 psf

## 1.4.7 Crane Load

The 2-ton crane is to be located in the RMF. The crane loadings and deflections shall be in accordance with the MBMA Low Rise Manual.

## 1.4.8 Lateral Partition Loads

The minimum design wind pressure on interior partitions shall be 5 psf normal to the partition.

## 1.4.9 Deflections

## 1.4.9.1 Roofs

Deflections of structural members shall not be greater than allowed by the applicable material standard (ACI, AISC, MBMA, etc.) and the limits set forth below. Deflection limits are needed to restrict damage to ceilings, partitions, other fragile nonstructural elements. Member deflection shall not exceed that permitted by TI-809-02 and TI 809-04. The deflection of structural members supporting roofs, due to dead load plus either live

load, snow load, or wind load, shall not exceed 1/240 of the span; and due to only live load, snow load, or wind load, shall not exceed 1/360 of the span.

#### 1.4.9.2 Structural concrete Masonry walls, Non-load bearing concrete masonry partitions and Brick veneer;

The lateral deflection (out-of-plane bending) due to loads shall not exceed 1/600 of the span. The vertical deflection (lintels) due to loads shall not exceed 1/600 of the span.

#### 1.4.10 Antiterrorism Consideration

This project shall be designed to meet the applicable portions of UFC 4-010-01, the Department of Defense Minimum Antiterrorism Standards for Buildings.

### 1.5 STRUCTURAL MATERIALS

The Design-Build contractor will establish the type of structure and construction used. In selecting the type of structural system, the total facilities should be considered, since the choice will influence such features as HVAC, architectural lighting, and utility requirements. The Design Build contractor shall give consideration to the availability of labor and materials when selecting the structural materials to be utilized.

The following is a list of structural materials that can be utilized solely or in combinations for the structural designs:

#### Refueler Maintenance Facility

Structural Steel  
Concrete  
Masonry (required to a height of 9'-4")  
Steel Joist  
Light Gage Steel

#### Operations Center

Structural Steel  
Light Gage Steel  
Masonry (Veneer required to a height of 7'-4")  
Metal Building System

#### Canopy (Bid Option)

Structural Steel

#### 1.5.1 Structural Steel

##### 1.5.1.1 Design

Structural steel shall be designed in accordance with AISC Specification for Structural Steel Buildings - LRFD. All structural steel members shall be designed by the structural engineer to support all applicable loads. Structural drawings shall clearly show all structural members, connections and their locations.

#### 1.5.1.2 Connections

Types of connections shall be consistent with the design assumptions for the basic type of steel construction used. Connection design shall be the responsibility of the structural engineer for the Design/Build Contractor and shall not be delegated to the steel fabricator.

#### 1.5.1.3 Steel Drift Limitations

Drift shall be no greater than the maximums recommended in AISC Design Guide 3.

#### 1.5.2 Steel Joists and Joist Girders

The design and selection of steel joists and joist girders shall be governed by the Steel Joist Institute (SJI) Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders. The net wind uplift requirements shall be clearly delineated on the drawings. Joists requiring special configurations or design to resist wind uplift and non-uniform loads shall be designated as such on the drawings and the required design loads indicated, per SJI recommendations. Joist end supports and anchorage to resist uplift shall be designed to accommodate the applied forces, including those resulting from wind and seismic activity.

#### 1.5.3 Steel Decking

The design and selection of steel deck shall be in accordance with the provisions of the Steel Deck Institute (SDI) Design Manual. Minimum required section properties of deck sections shall be determined as prescribed by the appropriate Specifications of the SDI Design Manual, and shall be specified or indicated on the drawings. Where the steel deck is designed to function as a shear diaphragm, the design shall be in accordance with the provisions of the Steel Deck Institute (SDI) Diaphragm Design Manual and Army Corps of Engineers TI 809-04.

#### 1.5.4 Masonry

##### 1.5.4.1 Design

Masonry design shall be in accordance with US Army Corps of Engineers TM 5-809-3, TI 809-04 and FEMA 302. Reinforcement shall be sufficient to satisfy the calculated requirements for strength, shrinkage crack control, and seismic design. In no case shall reinforcement be less than the minimum seismic reinforcement required by TI 809-04 and FEMA 302. If masonry walls are used in conjunction with steel framing as non-load-bearing and non-shear-resisting elements, the connections between walls and the structural steel frames must be designed to allow vertical and horizontal frame deflection without transferring loads from steel to adjoining masonry walls. Use "Release 2.0 of the CADD details library by CADD/GIS Technology Center" for masonry details. Masonry details can be obtained from the following web address:  
[http://tsc.wes.army.mil/products/cadd\\_details/](http://tsc.wes.army.mil/products/cadd_details/)

##### 1.5.4.2 Crack Control

Concrete masonry crack control measures comprised of masonry control

joints, joint reinforcement, and bond beams shall be incorporated in the design of concrete masonry walls and partitions. Masonry Control Joints (MCJ) shall be judiciously located at spacings no greater than the maximums recommended in UFC 1-200-01 and shall be shown on the Architectural elevations. Control joints shall not be placed closer than 600mm to openings.

#### 1.5.4.3 Drift Limitations

Lateral drift at the top of brick due to wind loading will be limited to  $H/600$  (not to exceed  $3/8$ "), where "H" is the full height of the brick from the top of foundation to the top of brick. Out of plane deflection due to bending of the brick veneer/ Metal stud backup shall not exceed  $H/600$ .

Amplified lateral drift at the top of brick due to Seismic loading will be limited to  $H/240$  (not to exceed  $2\ 1/2$ "), where "H" is the full height of the brick from the top of foundation to the top of brick. Amplified Out of plane deflection due to bending of the brick veneer/ Metal stud backup shall not exceed  $H/600$ .

#### 1.5.5 Reinforced Concrete

##### 1.5.5.1 Design

Reinforced concrete design shall be in accordance with ACI 318 and related current ACI publications which are applicable to the design, TI 809-02, and Army Corps of Engineers TI 809-04, as applicable. All concrete elements, including slabs-on-grade, shall be reinforced with temperature and shrinkage reinforcement as a minimum. Temperature reinforcement shall be as recommended by ACI and TI 809-02, as appropriate.

##### 1.5.5.2 Reinforcing Bar Usage Limitations

Grade 60 bars shall be used for concrete design. Minimum bar size shall be #4 bars except for stirrups and ties which may be #3 bars as per ACI.

##### 1.5.5.3 Concrete Joints

Control joints and contraction joints shall be located to reduce concrete cracking to a minimum. All exposed concrete joints shall be sealed with appropriate joint sealants.

##### 1.5.5.4 Concrete Strength

The minimum concrete compressive strength shall be 4000 psi.

##### 1.5.5.5 Light Gage Steel

Light Gage Steel design shall be in accordance with the American Iron and Steel Institute (AISI), "Specifications for the Design of Cold-Formed Steel Structural Members", "Design of Cold-formed Load-bearing Steel Systems", and TI 809-07.

#### 1.6 STRUCTURAL FRAMING SYSTEMS

##### 1.6.1 General

##### 1.6.1.1 Main Structure

The structural systems used for the lateral loadings shall be selected and

designed by the Contractor. The Basic Seismic-Force-Resisting System shall conform to one of the types indicated in Table 7-1 of TI 809-04 and Table 5.2.2 of FEMA 302 subject to the limitations on height based on the *Seismic Design Category* indicated in the table. In case of conflict between Table 7-1 of TI809-04 and Table 5.2.2 of FEMA 302, values from Table 5.2.2 of FEMA 302 governs. The lateral load resisting system shall incorporate bracing, moment resisting frames, shear walls, diaphragms, or any combination thereof, provided the elements of the system are compatible with the attached architectural floor plan. Cold-formed light-gage metal framing (i.e., steel studs) systems shall be designed in accordance with TI 809-07.

#### 1.7 Roof Framing

The roof buildings shall slope as required for the type of roofing system used. The roof slope shall be accomplished by sloping of the structural framing members. The design of roof framing members shall include consideration of any concentrated loads from suspended mechanical and electrical equipment, including cable trays and HVAC units. The location and magnitude of suspended equipment loads shall be closely coordinated with the mechanical and electrical system designs.

#### 1.8 Location of Structural Elements

Structural elements, including columns, bracing, shear walls and load-bearing walls shall be located as required by the structural design. The structural design and corresponding selection and location of structural elements shall be compatible with the floor plan, roof plan, elevations and other architectural drawings included in the attachments to this document. Columns shall be located in walls, and in such a manner that doorways or other accessways are not obstructed. Pilasters and in-wall columns which protrude into the room spaces are not allowed. Use of structural bracing shall be minimized, and shall be limited to locations where bracing is concealable at interior or exterior wall lines and does not obstruct windows, doors or other openings. Shear walls, where used, shall be located in coordination with architectural partition requirements.

#### 1.9 Interior/Exterior Walls

##### 1.9.1 Non-load bearing walls

Non-load-bearing walls shall be laterally braced by the roof structure, and shall be connected in a manner which provides for vertical deflection of the roof structure without inducing vertical loads into the wall.

##### 1.9.2 Shear Walls

Shear walls, where used, shall be constructed of cast-in-place reinforced concrete, reinforced concrete masonry units, or cold formed steel panels with diagonal steel straps at the Design/Build Contractor's choice. Shear walls shall be designed in accordance with ACI 318, TM 5-809-3, TI 809-07, FEMA 302 and Army Corps of Engineers TI 809-04.

#### 1.10 FOUNDATION SYSTEMS

Foundation system shall be designed in accordance with Section 01293 "Kansas City District Structural Controlling Criteria" and The Subsurface Investigation Report (section 01011). The components of the foundation system shall be constructed of reinforced concrete. The required 28-day

compressive strength of concrete for the foundations shall be 4000 psi minimum. All parts of the foundation system shall be designed to keep dead load footing pressures relatively uniform, in order to minimize differential settlements. The slabs-on-grade shall be reinforced slabs having a minimum thickness of 4 inches with the actual thickness and design based on actual design loads. All slabs-on grade shall be underlain by a 6 mil vapor barrier over 6 inches of capillary water barrier. For addition requirements refer to section 01011.

#### 1.10.1 Design Parameters

Parameters used for foundation design, including the allowable soil bearing pressure, lateral earth pressure coefficients and design footing depths shall be in accordance with the Final Foundation Analysis report provided in Section 01011. The allowable soil bearing pressure represents the allowable soil stress at the base of footings in excess of that due to existing overburden. The weight of any fill added to the site above that required for frost protection shall be subtracted from the allowable soil bearing pressure to arrive at a net allowable pressure due to structural loads.

#### 1.10.2 Foundation Perimeter Insulation

Perimeter insulation shall be installed on the interior face of all exterior perimeter foundation walls. Insulation shall extend from the bottom of the floor slab down to top of footing or down to design frost depth.

#### 1.10.3 Structural Stoops at Exterior Doorways

All exterior pedestrian doorways require structural stoops. Stoops shall have foundation walls extending down to frost depth and shall be rigidly attached to building foundation walls. Stoops shall have a 12 inch layer of uncompacted fill placed directly beneath the stoop slab. The stoop slab shall be flush with the interior floor slab at the threshold and shall slope away from the building at 2% minimum slope.

#### 1.10.4 Hydraulic Lift Foundations

The hydraulic lift foundation shall be per the hydraulic lift manufacture's recommendations. The lift foundations shall be isolated from the building foundation.

### 1.11 CONCRETE FLOOR SLABS-ON-GRADE

Design of slabs shall be in accordance with TI 809-02 and the following detailed instructions:

#### 1.11.1 General

Slabs shall be designed as "floating slabs" without rigid edge support, and with lateral and vertical movement unrestrained. An isolation joint, consisting of a 1/2" layer of expansion joint material, is required where slabs abut vertical surfaces. Slab thicknesses shall be selected in accordance with TI 809-02 or as required by design. Slabs shall be reinforced with a minimum of 0.18 percent steel based on cross sectional area. Crack control measures shall be incorporated in the slab design. Control joint details and spacings shall be as delineated in TI 809-02.

### 1.11.2 Interior Concrete Slabs-on-Grade

Interior slabs-on-grade shall be a minimum of 4 inches thick placed over a 6 mil vapor barrier on top of a layer of crushed stone material with not less than 6 inches of compacted thickness. For additional requirements below slab-on-grade, refer to Section 01011. Where floor drains occur, the slab shall be sloped to drain. Maintain minimum slab thickness in the sloped area of the slab. All slab crack control joints, construction joints, isolation joints between edges of slabs and vertical surfaces, and any mechanical, plumbing or electrical penetrations through the floor slab shall be sealed with a flowable polyurethane caulk.

### 1.11.3 Interior Equipment Pads

Floor mounted mechanical and electrical equipment shall be installed on 6 inch thick raised concrete housekeeping pads. The pads shall be reinforced with at least the minimum temperature reinforcement required. The pads shall be sized 4 inches larger all around than the piece of equipment furnished and all edges of the pad shall be chamfered. The equipment pad shall be anchored to the slab-on-grade with minimum #4 spaced at 12" oc along the perimeter of the concrete pad.

### 1.11.4 Equipment Vibration Isolation

All vibration producing mechanical and electrical equipment shall be mounted in such a manner as to prevent the transfer of vibrations to adjacent parts or areas of the building. If necessary for any large vibration producing equipment installed within the facility, the equipment will be supported on individual isolated foundations. The isolated foundation shall be separated from the building slab by a continuous 3/4 inch expansion joint.

## 1.12 OTHER STRUCTURAL WORK

### 1.12.1 Standing Seam Roof Metal System

Standing seam metal roof shall comply with the requirements set forth in Technical Specification 07416 STRUCTURAL STANDING SEAM METAL ROOF (SSMR) SYSTEM and in SDCC. Final drawings will provide a list of loading criteria including roof live and wind uplift loads. A wind uplift diagram shall be used to identify wind uplift pressures and their locations on the roof. The component and cladding wind pressures for SSSMR shall be calculated based on 10 SQFT tributary area.

### 1.12.2 Exterior Equipment Pads

Any exterior mechanical or electrical equipment shall be installed on concrete pads. The pads shall be a minimum of 8 inches thick and shall be reinforced with at least the minimum temperature reinforcement required. The pads shall be sized 6 inches larger all around than the piece of equipment furnished and all edges of the pad shall be chamfered. Design of exterior pads shall be coordinated with Mechanical and Electrical system designs.

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --



## SECTION 01016

## MECHANICAL REQUIREMENTS

02/02

## PART 1 TECHNICAL REQUIREMENTS

This Section contains instructions and engineering requirements relating to the design of the new mechanical systems for the Refueler Maintenance Facility (RMF), POL Operations Center (POLOPS), and Military Fuel Pumps. The design of all systems shall comply with the standards listed below in the Reference section. Delineation of the mechanical work between the building and the site utilities construction shall generally, with the exception of the natural gas system, be a point 5 feet outside of the building. The design and installation of all mechanical systems, including manufacturer's products, shall meet the instructions and requirements contained herein and the requirements of the provided technical guide specifications. Where conflicts between these instructions and the guide specifications or criteria exist, these instructions shall take precedence.

Any installation requirements within these instructions, but not contained in the specifications, shall be added to the specifications or shown on the drawings. The HVAC system type for the Refueler Maintenance Facility (RMF) and POL Operations Center (POLOPS) has been selected by the government on the basis of lowest Life Cycle Cost as required by Federal Law 10CFR436 to approach the Energy Use Budget (EUB) as required by Federal Law 10CFR435. Individual mechanical equipment selection by the designer shall also consider life cycle operability based on 25 years, maintenance and repair of the facility and real property installed equipment components and systems. The mechanical systems of the Refueler Maintenance Facility (RMF) shall consist of gas distribution, plumbing, all water hydronic heating with overhead unit heaters for the maintenance bays, gas fired unitary heating and split system DX cooling equipment for non-work bay areas including administration, air supply, distribution, ventilation, exhaust systems, and direct digital control systems with the following components as specified herein. The mechanical systems of the POL Operations Center (POLOPS) shall consist of gas distribution, plumbing, all hydronic hot water heating, split system direct expansion cooling, two-deck multizone air handler for administration, air supply, distribution, ventilation, exhaust systems, and direct digital control systems with the following components as specified below. The mechanical systems of the Military Fuel Pumps shall consist of new tank truck bulk off-loading, tank truck bulk loading, and ground vehicle dispensing pumps and dispenser for the two existing above ground tanks 3 and 4, and ground vehicle dispensing pumps and dispenser for the two existing underground tanks 7 and 8 as specified below.

- a. Interior Gas Piping Systems.
- b. Thermal Insulation of Mechanical Systems.
- c. Plumbing Systems.
- e. Hydronic Heating Systems.
- f. Pulse boilers.
- g. Refrigeration/Chilled Water Systems.
- j. Hot and chilled water pumps.
- k. Horizontal, ceiling hung, DX-type computer room or fan coil unit one per communication room.
- l. multi-zone air handler.
- o. Exhaust fans

- p. Propeller Unit Heaters (Located in the mechanical rooms.
- q. Appropriate DDC controls for all systems.

All equipment installed shall be capable of maintaining the design conditions for all spaces throughout the life of the facility. Ease of access to components and systems in accordance with industry standards and safe working practices is a design requirement. Maintenance clearances shall be as minimum as recommended by the equipment manufacturer. All like equipment and accessories shall be from a single manufacturer.

#### 1.1 General Mechanical Requirements

As applicable, the following shall be provided for all new mechanical systems:

##### 1.1.1 Design Submittals

Drawings, specifications, design analysis and calculations shall be provided in accordance with SECTION 01019 - DESIGN AFTER AWARD-35 PERCENT, SECTION 01020 - DESIGN AFTER AWARD-60 PERCENT and SECTION 01021 - DESIGN AFTER AWARD-100 PERCENT.

##### 1.1.2 National Electrical Code NFPA 70 (NEC), Class 1 Requirements.

The NEC requirements apply to all facilities, and shall be exceeded as follows; All equipment installed above the floor, including near the roof, in the Work Bays and Inspection Bay of the Refueler Maintenance Facility (RMF) shall meet Class 1 Division 1 requirements. Other requirements, including Class 1 Division 1 area, per NEC shall apply.

##### 1.1.3 Technical Specifications

For minimum technical specification requirements see SECTION 15000 - MECHANICAL SYSTEMS - OUTLINE SPECIFICATIONS.

##### 1.1.4 Equipment Efficiency

Mechanical equipment shall be energy efficient per Executive Order 12902, 13123 and ASHRAE/90.1. Where products are not yet rated as energy efficient products by ENERGY STAR (Registered Trademark) the Contractor should strive to provide products that meet the above criteria and be in the upper 25 percent of energy efficiency as designated by FEMP.

##### 1.1.5 Mechanical/Electrical Equipment Coordination

Arrangement of all mechanical equipment and piping shall be coordinated with electrical work to prevent interference with electrical components. Special care shall be taken with conduits and other components that may run through the mechanical room and to insure adequate space in shared chases. Mechanical equipment (pipes, ducts, etc. unless items solely serve the area) shall not be installed OVER OR WITHIN SPACE which is dedicated to transformers, panelboards, or other electrical equipment unless items solely serve the area. When electrical equipment is located in a mechanical equipment room, the dedicated electrical space shall be indicated by a dashed line and noted "Electrical Equipment Space".

##### 1.1.6 Finished Spaces.

All piping and equipment located in finished areas of the building shall be

concealed or furred-in; exposed piping and equipment is only allowed in utility, equipment, storage and other rooms of this nature.

#### 1.1.7 Mechanical Spaces.

There is some flexibility in the size of some of the mechanical spaces. All mechanical rooms and yards shall have sufficient size as required to house all mechanical equipment and provide adequate clearance as specified below. All clearances required by the equipment manufacture for operation, routine maintenance, and replacement of minor and major components shall be provided for all mechanical equipment. Piping and supports shall not interfere with equipment maintenance access or pull space. In addition a minimum of 2 feet clear shall be provided around all mechanical equipment. Ample space shall be provided around equipment to allow unobstructed access for entry, servicing, and routine maintenance to include pull space for service and/or replacement of filters, coils, motors, boilers and other equipment items. Pull space provided in rooms for service and/or replacement of mechanical equipment items shall be indicated with broken (dashed) lines on the drawings. Provisions for installation, removal, and future replacement of equipment shall be coordinated with the architectural design. The arrangement, selection, and sizing of all mechanical equipment shall be such that it can be broken down and removed from the building without dismantling any adjacent systems or structures. All required clearances shall be provided for government acceptance to verify mechanical space layout. Servicing and maintenance areas interior and exterior to building shall be sized according to manufacturer's recommendations for equipment. All pipe insulation shall be jacketed within 6 feet above the finished floor.

##### 1.1.7.1 Mechanical Room.

The mechanical room shall house the boilers, air handling units, domestic hot water heating system, all pumps, and miscellaneous equipment. The gas service, domestic service and fire service enterances shall also be located in the mechanical room. The mechanical equipment room layouts shall be provided with ample floor space to accommodate routine maintenance of equipment and have head-room to accommodate required equipment as specified above.

##### 1.1.7.2 Mechanical Equipment Yard.

The mechanical equipment yard shall house the air cooled condensing unit(s). The equipment yard shall be as specified in Section 01012, SITE WORK/CIVIL/UTILITIES. In addition, ample space shall be provided around all cooling equipment to allow adequate air flow for heat rejection with consideration to the type of screening provided. At a minimum, all clearances shall be per the manufacture's recomendations.

#### 1.1.8 Roof Mounted Equipment

Except for plumbing vents and boiler vents, no other mechanical equipment shall be located on the roof of the facility.

#### 1.1.9 Safety, Noise and Security.

Equipment shall be selected to meet the following safety, noise, and security criteria:

##### 1.1.9.1 Rotating Guards.

All mechanical equipment selected shall have proper guards for rotating parts.

#### 1.1.9.2 Noise.

All equipment selected shall not produce objectionable noise or vibration in occupied areas. All air supply devices shall be selected to have a noise criteria rating of NC30 or less.

#### 1.1.9.3 Vibration Isolation/Equipment Pads

Provide vibration isolation devices on all new floor mounted or suspended mechanical equipment. All new floor mounted mechanical equipment shall be provided with housekeeping pads. Housekeeping pads shall be as specified in Section 01015, Structural Requirements.

#### 1.1.9.4 Mechanical Rooms.

All mechanical rooms shall be secured and shall have access by only authorized personnel.

#### 1.1.9.5 Fire Rated Walls

Fire-rated of walls shall be as required in Section 01013 ARCHITECTURAL BUILDING REQUIREMENTS.

### 1.2 General Facility Descriptions and Requirements

#### 1.2.1 Refueler Maintenance Facility (RMF)

The purpose of the facility is for repair of refueler vehicles, which are are completely full in most cases, and can weigh 68,000 lbs, with the fuel weight at 40,000 lbs. Thus an empty truck weighs 28,000 lbs. The R-11 refueler truck is 22 ½ feet long and the R-12 refueler truck is 14 feet long. All work shall conform to MIL-HDBK-1022A, Petroleum Fuel Facilities, UFC 3-600-01, Fire Protection Engineering for Facilites, Industrial Ventilation by ACGIH, and other references listed in this section.

#### 1.2.2 POL Operations Center (POLOPS)

The purpose of the facility is to control fuel dispensing at the installation. All work shall conform to MIL-HDBK-1022A, Petroleum Fuel Facilities, UFC 3-600-01, Fire Protection Engineering for Facilites, Industrial Ventilation by ACGIH, and other references listed in this section.

### 1.3 HVAC Load Calculations.

This Section contains instructions and engineering requirements relating to the design of the new HVAC supply and distribution systems. The design of all systems shall comply with the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Handbooks, Terminology of HVAC&R guide and to the requirements of NFPA Standards Nos. 90A. Load calculation procedures shall be based on ASHRAE. Calculations shall be provided for all mechanical equipment such as boilers, heating & cooling coils, condensing units, unit heaters, piping, pumps, expansion tanks, fans, ducts, louvers, gas services and piping, plumbing, water

heaters, and etc. Deleted sentence.

1.3.1 Safty Factors

A 20% safety factor shall be applied to the total room-heating load. A 10% safety factor shall be applied to the total room-cooling load.

1.3.2 Infiltration Rates.

All outdoor air shall be introduced into the occupied portions of the buildings through the air handling unit or the blower coil unit. Therefore, all occupied spaces shall be positively pressurized. However, for the purposes of sizing equipment, an infiltration rate of 0.5 air changes per hour (ACH) shall be included for all rooms with an exterior exposure. A rate of 4 ACH shall be allowed for the vestibules. Deleted sentence.

1.3.3 Building Thermal Properties.

Building thermal properties shall be as follows;

<u>Coefficient of Heat Transmission ("U" Value)</u>	
<u>Roofs</u>	<u>0.030 Btu/square ft - degree F</u>
<u>Walls</u>	<u>0.058 Btu/square ft - degree F</u>
<u>Windows</u>	<u>0.31/0.32 Btu/square ft - degree F (winter / summer)</u>
<u>Exterior doors shall be hollow metal with rigid insulation cores.</u>	

These values represent the minimum acceptable level of building insulation. The mechanical designer shall verify the actual building materials meet or exceed these values. If the building envelop fails to meet these levels, the mechanical designer shall inform the Contractor, the Architectural designer and the Contracting Officer's representative of the condition and recommended corrective action. A copy of all calculations shall be included in the design submittal.

1.3.4 Computer Programs.

Capacity of heating and cooling systems shall be based on load calculations for individual spaces as well as block loads. Heat loss and heat gain calculation shall use actual design U-values. All calculations shall be based on ASHRAE methods as computed by a commercially recognized computer HVAC loads program i.e., Elite Software Inc., Trane Trace Load 700, Carrier E20-II Hourly Analysis Program (HAP) version 3.04 . A copy of all load calculations, both input and output, shall be included in the design submittal.

1.3.4.1 Delete Paragraph

1.3.4.2 Delete Paragraph

1.3.5 Internal Heat Gains for Cooling Calculations

All installed electrical equipment shall be assumed to impose 100% resistive heating load on the space except as indicated below for return air plenums.

1.3.5.1 Lighting Loads

The heat gain from space lighting loads shall be coordinated with Electrical Design Engineer (see Section 01017 ELECTRICAL REQUIREMENTS). Where the space above the ceiling is a return air plenum, than a minimum of 70% of the heat gain from the lights shall be assumed to place a direct load on the space. A maximum of 30% of the heat gain from the lights shall be assumed to place a direct load on the return air plenum.

1.3.5.2 Communication Equipment Loads

The heat gain from the communication equipment installed in the communication equipment rooms shall be coordinated with Electrical Design Engineer (see Section 01017 ELECTRICAL REQUIREMENTS).

1.3.5.3 PC/monitor/printer Loads

The heat gain from each PC/monitor/printer combination shall be 240 watts total per station.

1.3.5.4 People Loads

The heat gain from people shall be 75 Watts/person sensible and 70 Watts/person latent for walking and standing per ASHRAE Handbook of Fundamentals.

1.3.5.5 Solar, Transmission, conduction, slab loads etc Loads

The heat gain from solar sources shall be as shown in ASHRAE Handbook of Fundamentals.

1.3.6 Deleted Paragraph

1.3.7 Deleted Paragraph

1.4 HVAC Load Calculations.

1.4.1 Heating & Cooling Equipment.

1.4.1.1 Outdoor Design Temperatures.

Outdoor design conditions shall be in accordance with TM 5-785 Engineering Weather Data.

1.4.1.2 Indoor Design Temperatures.

Mechanical designs shall give maximum consideration to the comfort of the occupants. The HVAC systems shall, at all times, maintain all occupied spaces, except for the restrooms, laundry and utility spaces, within the ASHRAE comfort zone as defined in Standard 55-1992, Thermal Environmental Conditions for Human Occupancy. The restrooms and laundry shall be maintained with in this same comfort zone when exterior temperatures and humidities are below the comfort zone. Actual indoor design conditions and setpoints, in degrees F, shall be as follows:

Occupied Areas	Heat/Cool	68/78, 50%RH
Storage/Rest rooms	Heat/(Vent)	68/84
Mechanical/utility	Heat/(Vent)	55/84

#### 1.4.1.3 Heating

All areas of the buildings shall be heated. Vestibules, etc, shall be heated for freeze protection of sprinklers only (or Mechanical design shall be coordinated with the Fire Sprinkler Installation for freeze protection).

#### 1.4.1.4 Cooling

All areas of the buildings shall be provided with mechanical cooling (via refrigeration) except for the RMF work bays, restrooms, vestibules, storage areas, mechanical rooms, and electrical rooms. The storage areas, mechanical rooms, and electrical rooms shall receive additional ventilation as specified below for summer cooling. Note, all communication room shall be provided with mechanical cooling and positively pressurized.

#### 1.4.1.5 Humidity

Humidity shall not be directly controlled in any space during the cooling season. Humidity control shall be limited to 50% relative humidity through good selection of the cooling coil. Deleted Sentence.

#### 1.6 Ventilation.

##### 1.4.2 Mechanical Ventilation.

The design shall insure that indoor air quality shall be maintained for all occupants during the occupied periods. Mechanical ventilation shall be provided to the buildings in strict accordance with ASHRAE Ventilation Standard 62. The maximum ventilation rate per system shall be calculated using the Ventilation Rate Procedure. The outside air rates for each system shall be corrected for multiple spaces as required by ASHRAE Ventilation Standard 62. A complete room by room ventilation analysis for each AHU shall be included in the design submittal.

##### 1.4.3 Combustion Air

The mechanical equipment rooms containing gas burning equipment that is not directly vented to the outdoors for both combustion air and combustion by-productst shall be provided with combustion air louver sized and located in accordance with NFPA 54. Care shall be taken in design in order to minimize the potential for piping freeze-up in the mechanical room due to combustion air intake.

##### 1.4.4 Building Exhaust.

A undercut door and/or transfer duct shall be required to allow for replacement air when required make-up air is specified to be transferred from adjoining spaces.

##### 1.4.4.1 Toilet Exhaust.

The toilets shall be supplied with 50 cfm of exhaust per water closet or urinal as required by ASHRAE Ventilation Standard 62 or a minimum of 10 air changes per hour, which ever is greater. The required make-up air for the exhaust system shall be transferred from adjoining spaces. Finned tube radiators, cabinet unit heaters, etc. can be used to supply heat.

#### 1.4.4.2 Janitors Closets

Janitors closets shall be exhausted at the rate of 50 cfm. The required make-up air for the exhaust system shall be transferred from adjoining spaces.

#### 1.4.4.3 Refueler Maintenance Facility Work Bay, Inspection Bay Emergency Exhaust

An emergency exhaust system shall be installed in the Work Bay and Inspection Bay of the Refueler Maintenance Facility providing 10 air changes per hour and activated by a push button located in the bay. For the Work Bay this is about 10,400 cfm. Spark proof exhaust fan(s) per AMCA, with aluminum wheels and housing, and explosion proof electric or air driven motors shall be provided. Louvers shown on Architectural Elevation Sheets above Work Bay and Inspection Bay garage doors shall be used, with intake on one side and exhaust on the other side of building. All equipment located in the Work Bay and Inspection Bay, including controls, shall meet requirements for NEC class 1 division 1 construction.

#### 1.4.4.4 Refueler Maintenance Facility Exhaust in Areas Adjacent to Work Bay, Inspection Bay

Install exhaust in areas adjacent to, and communicating with, the Work Bay or Inspection Bay in accordance with the National Electrical Code to prevent these areas from requiring hazardous construction.

#### 1.4.4.5 Summer Ventilation.

Ventilation shall be supplied in all parts of the building that do not receive summer cooling via mechanical cooling (i.e. the mechanical, electrical, and storage rooms). The space shall be ventilated and cooled with outside air by thermostatically controlled fans. The fans shall be set to operate when the respective space temperature exceeds 86 degrees F. The volume of air supplied shall be calculated using an assumed delta temperature of 10 degrees F or a minimum of 10 air changes per hour. A copy of all calculations shall be included in the design submittal.

#### 1.4.5 Building Pressurization

Entire building shall be pressurized to reduce infiltration. A building air balance calculation shall be included with the complete room by room ventilation analysis for each AHU specified above. A relative positive or negative pressurization shall be as specified below:

##### 1.4.5.1 Restrooms and Janitor's Closet

The restrooms and janitor's closet shall be maintained at a negative pressure relative to the rest of the facility. Supply air to these rooms shall be limited to the smaller volume of volume required to meet the heating load or 90 percent of the exhaust air volume. Remaining exhaust air shall be transferred from adjacent spaces.

##### 1.4.5.2 Control Rooms for POL Operations Center.

The Control Rooms shall receive filtered conditioned relief air transferred

from the main ceiling plenum into the communication rooms to maintain the space under positive pressure.

#### 1.4.6 Building Envelop Penetrations.

All building envelop penetrations for ventilation, supply, exhaust and relief, shall be provided with low leak motorized control dampers to maintain a tight building envelop anytime the ventilation is not required.

##### 1.4.6.1 Building Outside Air Intakes.

Air intakes to heating, ventilation, and air conditioning (HVAC) systems shall be located at least 10 feet above the ground. Building envelop penetrations for outside air intake shall be located in the roof and/or clear story walls. A minimum of 40 feet shall be maintained between outside air intakes and any boiler exhaust vents, plumbing vents, the exhaust air or relief air penetrations. If feasible, locate intakes and exhausts on different building faces.

##### 1.4.6.2 Building Relief Air.

All building relief air shall not be returned to the air handling units prior to being relieved or exhausted from the building. Building relief penetrations shall include a gravity backdraft damper in series with the motorized control damper required above.

#### 1.5 Force Protection

In addition to the requirements listed below, the mechanical design shall include the following measures for force protection:

##### 1.5.1 Emergency Shutoff or Kill Switch

Provide an emergency shutoff switch in the HVAC control system that can immediately shut down air distribution throughout the building. The switch (or switches) must be located to be easily accessible by building occupants. The actual location shall be determined during design. If the occupant so directs, than the switch shall be located the greatest distance possible from the equipment location.

##### 1.5.2 Utility Service Entrance

For all new inhabited buildings, route critical or fragile utilities so that they are not on exterior walls. Secure exterior access to gas mains, and water supplies with manual shut-off valves.

##### 1.5.3 Building Outside Air Intakes.

Air intakes to heating, ventilation, and air conditioning (HVAC) systems shall be located at least 10 feet above the ground.

##### 1.5.4 Equipment Bracing

Mount all overhead utilities and other fixtures to minimize the likelihood that they will fall and injure building occupants. Design all equipment mountings to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction. This standard does not preclude the need to design equipment mountings for forces required by other criteria such as seismic standards.

## 1.6 Seismic Protection

The facility is to be considered seismic use Group I, and site classifications indicated in Section 01015 STRUCTURAL REQUIREMENTS.

### 1.6.1 Fire Protection Systems

Seismic protection for sprinkler systems for fire protection systems shall be as required by the current issue of the National Fire Protection Association NFPA 13.

### 1.6.2 All Other Mechanical Systems and Equipment

All other mechanical equipment, piping and ductwork shall be provided with seismic protection as required by TI 809-04, Seismic Design for Buildings and FEMA 302.

### 1.6.3 Materials and Installation

When seismic protection is required, the seismic restraints shall be designed in accordance with UFGS Section 13080A, SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and shall meet the requirements of Section 15070A, SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT.

## 1.7 Mechanical Insulation Systems

Insulation requirements of new mechanical systems, including insulation of plumbing systems and equipment, hot water piping systems, chilled water piping systems and equipment, and the insulation of the duct systems shall meet the requirements of Section 15080A THERMAL INSULATION FOR MECHANICAL SYSTEMS. All hot and chilled water piping shall be insulated. Hot water piping shall be required to follow tabulated thicknesses. Domestic hot and cold water piping shall be insulated. All ducts shall be insulated in the mechanical rooms. All supply and outside air ducts shall be insulated regardless of location. Cold piping and ductwork shall have a vapor barrier. High abuse areas shall have aluminum jackets such as janitor closets and mechanical rooms, within 6 feet above the finished floor.

## 1.8 Natural Gas Piping System.

The facility shall be provided with natural gas. This Section contains instructions and engineering requirements relating to the design of new interior natural gas piping systems. Interior gas piping systems shall extend from the outlet of the gas service regulator/meter assembly to the point of connection of each gas utilization device. Natural gas shall be provide to the boilers and domestic hot water heater. The aboveground gas piping system shall be designed, sized and installed in accordance with NFPA 54.

### 1.8.1 Gas Service Entrance

The gas service shall not be located on the front elevation of any building. The gas service shall be located as far from the front elevation of any building as practical, and the vent for the gas meter and gas regulators shall be at least 30 feet from outside air intake louvers. An anodeless riser shall be provided where PVC is connected to a metal riser prior to entering the building. An emergency gas connection shall be provided, with a sign stating "EMERGENCY GAS CONNECTION" located on the

adjacent wall.

#### 1.8.2 Gas Piping

Piping shall be sized in accordance with NFPA 54 to supply the demand without excessive pressure drop between the point of delivery and the gas utilization equipment. The pressure at the outlet of the meter set at the building's service entrance to the inlet of the individual appliance pressure regulators shall be 2 psig. Deleted sentence. Design for all piping for all systems, valves, regulators, etc. shall be per applicable industry criteria and standards and as referenced in above. All materials used for piping, valves and miscellaneous equipment shall meet or exceed the calculated design pressures, loads and stresses for each system. During design of the piping systems, consideration shall be given to future operations and maintenance activities. All systems shall be capable of being maintained with a minimal amount of disassembly of all assemblies and sub-assemblies. Interior piping shall be black steel as specified in Section 15190A, GAS PIPING SYSTEMS. Minimum interior gas pipe size shall be 3/4 inch. Gas piping shall be shown on the mechanical HVAC Drawings. The following items shall be provided as part of the building's natural gas system in the order listed below;

#### 1.8.3 Automatic Shut-off Natural Gas Safety Device

A separate automatic shut off device shall be located up stream of regulators at the service entrance to the building. The safety device shall be a mechanical, pilot operated device which does not require electrical power to operate. The pressure sensing element of the pilot operated device shall be located down stream of first regulators to cut off gas flow if the supply pressure to the building exceeds the safe inlet pressure to all down stream regulators.

#### 1.8.4 Building Regulator

Coordinate with base on natural gas distribution pressure prior to design. The designer shall verify the actual gas pressure in the existing gas main. Natural gas shall be distributed within the building at about 2 psig with an inline regulator near appliance reducing pressure as required. The building regulator shall have a maximum turn down ratio of 20 to 1. This may result in two building natural gas regulators in series if supply pressure is greater than 40 psig. The contractor shall submit shop drawing showing natural gas regulator(s) inlet and outlet pressure recommended orifice diameter, and orifice diameter installed, to insure its within the manufacturer's recommendation for the gas system pressure design. Install a pressure relief valve immediately downstream of the building service pressure regulator (prior to the meter), even if the regulator is equipped with an integral pressure relief valve.

#### 1.8.5 Gas Meter

A gas meter shall be provided for each building (POL and Refueler Maintenance facilities). The gas meter shall contain visual readout and pulse initiator connected to the base wide EMCS system. Readout shall index in cubic feet.

#### 1.8.6 Appliance Regulator

Each piece, except as noted below, of equipment which is fired by natural gas shall be provided with a separate gas pressure appliance regulator to

reduce the gas pressure to the value as recommended by the manufacture of the gas burning appliance. When multiple pieces of the identical gas burning equipment, such as boilers, are to be installed in the same room a single appliance regulator shall be provided for the group of identical equipment. Other equipment with in the same room maybe combined onto a common appliance regulator if all equipment served by the common appliance regulator require the same inlet gas pressure.

#### 1.8.7 Equipment Connections

The final connection to gas equipment shall be made with rigid metallic pipe and fittings. Accessible gas shutoff valve and coupling are required for each piece of gas equipment.

#### 1.9 Plumbing System.

This Section contains instructions and engineering requirements relating to the design of the new plumbing systems as required. A plumbing system consists of the Drain Waste and Vent system (DWV) system; the domestic hot and cold water supply distribution system to the various plumbing fixtures; and the Domestic Hot Water Heating System; make-up water piping to the various hydronic type environmental control systems; and shall extend from connections within the structure to a point 5 feet outside the structure. The design of all plumbing systems shall, unless otherwise stated herein, comply with the most current TM 5-810-5 and International Plumbing Code (IPC) and shall meet the requirements of Section 15400A PLUMBING, GENERAL PURPOSE. The quantity of plumbing fixtures shall be as shown on the contract Architectural drawings. The designer shall submit for review all plumbing calculations demonstrating his pipe sizing methods and assumptions.

##### 1.9.1 Piping Runs

Piping runs in buildings shall be arranged to not interfere with movement of personnel and equipment. Neither water nor drainage piping shall be located over electrical equipment or panels. Domestic water piping located outside of mechanical equipment areas shall be routed in the ceiling space above the corridors. Water and waste piping shall not be located in exterior walls or other spaces where there is possibility of freezing. Where piping is to be concealed in wall spaces or pipe chases, such spaces shall be checked to insure that clearances are adequate to properly accommodate the piping.

##### 1.9.2 Soil, Waste and Vent Piping System.

Horizontal soil and waste piping shall be installed at a uniform pitch in accordance with the International Plumbing Code (IPC) in the buildings. Soil, waste and vent stacks shall be located to serve each fixture or group of fixtures depending on fixture proximity to stack. Material type shall be as specified in Section 15400A, Plumbing, General Purpose.

###### 1.9.2.1 Piping Invert Elevations

All building underslab piping elevations should be shown on the drawings. Verify that the pipe elevations do not conflict with building structural footings and foundations walls.

###### 1.9.2.2 Floor Drains

Floor drains shall be provided as shown in section 01018, Space Data Sheets. The mechanical equipment rooms shall be provided with sufficient floor drains to accommodate routine maintenance and drain down of equipment and piping within the room without running drain pipes over the floor. In addition, a floor drain shall be provided in the mechanical room and janitors closet. To prevent traps from drying out, deep seal traps shall be provided on all floor drains.

#### 1.9.2.3 Cleanouts

On straight runs of pipe, cleanouts shall be provided at not more than 50 feet apart. Cleanouts shall be provided at each change of direction of pipe and shall be provided at the base of all storm, soil, waste, and vent stacks.

#### 1.9.2.4 Oil Water Separator for Refueler Maintenance Facility

An oil water separator shall be provided for the Refueler Maintenance Facility to serve trench drains in the Work Bays and Inspection Bay.

#### 1.9.2.5 Plumbing Vents

Where feasible, combine circuit vents in a concealed space to a main vent through the roof in lieu of an excessive number of individual vents through the roof. All vent lines through roof shall be 4 inches and terminate with a minimum of 6 inches above finished roof. Where vents connect to horizontal soil or waste lines, the vent shall be taken off so that the invert of the vent pipe is at or above the centerline of the horizontal soil or waste pipe.

#### 1.9.3 Domestic Potable Water System.

Domestic potable water pipe sizing criteria shall be based on a system supply pressure, residual pressure, and flow rate to provide a minimum of 25 psig at the most hydraulically remote fixture. The system supply pressure, residual pressure, and flow rate as specified in Section 01018, FIRE PROTECTION REQUIREMENTS. Water service entrance shall be sized for the maximum probable demand. Water piping shall be designed not to exceed a velocity of 8 feet per second at full flow. All domestic potable water piping shall be nonferrous as specified in Section 15400A, Plumbing, General Purpose. All materials used for piping, valves and miscellaneous equipment shall meet or exceed the calculated design pressures, loads and stresses for each system. During design of the piping systems, consideration shall be given to future operations and maintenance activities. All systems shall be capable of being maintained with a minimal amount of disassembly of all assemblies and sub-assemblies.

##### 1.9.3.1 Water Service Entrances

New water service entrances shall be provided with a water meter and isolation valves located inside the building. Meters shall be provided with a direct non-resettable, digital readout. Meters shall have a pulse switch initiator capable pulse output of operating up to speeds of 500 pulses per minute with no false pulses and shall require no field adjustments or 4-20 mA output. Initiators shall provide the maximum number of pulses up to 500 per minute that is obtainable from the manufacturer. Meters shall be connected to the EMCS system.

##### 1.9.3.2 Protection of Water Supplies

Cross connections between water supply piping and waste, drain, vent, or sewer piping are prohibited. Exterior water fountains shall be connected to the domestic water to the building and be provided with a reduced pressure principle type backflow preventor. Reduced pressure type backflow preventers shall be provided on all make-up water systems. All backflow preventers shall be installed for accessibility per International Plumbing Code (IPC) and shall comply with the requirements of the State of Kansas regulations. State licensed plumbers shall install and/or test backflow preventors and cross connections devices. For Fire Protection backflow preventor requirements see Section 01018 FIRE PROTECTION REQUIREMENTS.

#### 1.9.3.3 Water Hammer Arresters

Commercially available water hammer arresters shall be provided at all new quick closing valves such as flush valves and solenoid valves and shall be installed according to manufacturers recommendations. Vertical capped pipe columns in lieu of water hammer arresters are not permitted.

#### 1.9.3.4 Deleted Paragraph

#### 1.9.3.5 Freeze-Proof Wall Hydrants and Hose Bibbs.

Exterior freeze-proof wall hydrants with vacuum-breaker-backflow-preventer shall be provided on the exterior of the buildings to accommodate a maximum hose length of 100 feet. Wall hydrant drops shall be installed within interior partitions to eliminate freeze potential. A wall hydrant shall be provided near all Mechanical Room's exterior doors. Exterior wall hydrants shall be mounted 2 feet above finished grade.

The Refueler Maintenance Facility (RMF) shall contain interior hose bibbs, one at each end of the Work Bay, and one in Wash Bay. An interior hose bibb shall be provided in all mechanical rooms. All hose bibbs shall be mounted 3 feet above the finished floor.

#### 1.9.3.6 Deleted Paragraph

#### 1.9.3.7 Service Stop Isolation Valves

For normal maintenance or replacement, servicing stop isolation valves shall be installed in water connections to all installed new equipment and new fixtures. In addition, stop valves shall be provided to isolate portions of systems so as to not require shutdown of entire systems. Stop isolation valves for piping and equipment shall be shown on the drawings. Service stop isolation valves to faucets shall meet ANSI/NSF 61, section 9 lead leaching requirements.

#### 1.9.4 Domestic Hot Water Heating System.

Domestic water heating system shall be located in the mechanical equipment rooms. Heater(s) shall be natural gas fired with a combined or separate water storage tank(s). The capacity of the water heater(s) shall be adequate to meet the peak hot water requirements of the facility and shall be designed in accordance with Chapter 48, Service Water Heating, of the 1999 ASHRAE HVAC Applications Manual. The domestic hot water heater(s)

and/or storage tank(s) shall be selected to provide the combination of recovery capacity and usable storage capacity to the building as required by ASHRAE. Only 75 percent of the installed storage capacity shall be considered usable in calculating the required recovery rate.

#### 1.9.4.1 Equipment Size Limitations.

Size limit of individual storage tanks or domestic hot water heaters shall be limited to a size that can be removed and replaced through the mechanical room door on a dolly without dismantling the building, the door, the domestic hot water heater, the storage tank or any other installed mechanical equipment, piping or ductwork.

#### 1.9.4.2 Domestic Cold Water Inlet Temperatures.

An inlet water temperature of 50 degrees F. shall be used for sizing the water heaters.

#### 1.9.4.3 Domestic Hot Water Supply Temperatures.

Domestic hot water shall be supplied to the building for general use at a temperature of 140 degrees F.

#### 1.9.4.4 Domestic Hot Water Storage Temperatures.

Water storage temperature shall be 140 degrees F. as a minimum to prevent bacterial growth within the tank.

#### 1.9.4.5 Deleted paragraph

#### 1.9.5 Domestic Water Pumps.

Domestic hot water pumps shall be all bronze centrifugal pumps. Pumps and motors shall be properly sized for the application required. Pump capacity, efficiency, motor size, speed and impeller types shall be optimized for the application. Pump motor shall have the required capacity to prevent overloading with pump operating at any point on its characteristic curve. Pumps and motors shall operate at 1800 RPM (maximum).

##### 1.9.5.1 Domestic Water Circulation Pumps.

When separate heater and storage tanks are provided, one or more individual domestic hot water pumps shall be provided to circulate hot water between the hot water storage tanks and the heater separate from the domestic hot water recirculation pump.

##### 1.9.5.2 Domestic Water Recirculation Pumps.

Each domestic hot water system shall have a domestic hot water recirculation pump to recirculate 5 gpm of domestic hot water from within a minimum of 50 feet of every plumbing fixture that utilizes hot water within the building and back to the heating system. The system shall continually circulate domestic hot water in order to insure that domestic hot water is available at each fixture without delay. In buildings operated on a nominal 40-hour week or on a nominal two-shift basis (either a 5-or a 7-day week) a clock or other automatic control shall be installed on domestic hot water circulation pumps to permit operation only during periods of occupancy plus 30 minutes prior.

### 1.9.5.3 (Re)Circulation Pipe Sizing Criteria.

The piping systems shall be sized to limit pressure loss and noise. Pipes 2 1/2 inch and larger shall be sized for a maximum pressure loss of 4 feet per 100 feet. Pipes 2 inches and smaller shall be sized for a maximum velocity of 4 feet per second.

### 1.9.5.4 Computer Program or Spreadsheet.

The pressure loss, velocity and volume of each piping segment shall be calculated by a computer program/spreadsheet, based on the actual pipe material installed for each piping segment. The computer program/spreadsheet shall calculate the pressure loss through each and every individual flow path of each system to determine the maximum pressure lost of the system. The computer program/spreadsheet shall also calculate the total system volume. A copy of all calculations, both input and output, shall be included in the design submittal.

### 1.9.6 Plumbing Fixtures.

Plumbing fixtures shall conform to ASME standards and Executive Order 12902 with lead-free faucets. End-point devices shall meet lead leaching requirements of ANSI/NSF 61, section 9, lavatory faucets, kitchen and bar faucets, supply stops and endpoint control valves. All plumbing fixtures shall be the water conservation types as specified in Section 15400A, Plumbing, General Purpose.

#### 1.9.6.1 Handicapped Water Cooler Drinking Fountains

Handicapped water cooler drinking fountains shall be Elkay model EBFSA8 or equal. Front and side push bars, stainless steel finish, ADA compliant, no lead design. For non-handicapped water cooler drinking fountains, use Elkay model LWAE8 or LWCE8, or equal. Drinking fountains shall meet the requirements of NSF 61, Section 9. Water cooler drinking fountains shall: be self contained, conform to ARI 1010, use one of the fluorocarbon gases conforming to ARI 700 and ASHRAE 34 which has an Ozone Depletion Potential of less than or equal to 0.05.

#### 1.9.6.2 Shower Receptors

Shower Receptors; Florestone Terrazzo Shower Receptor model 200 or equal, tan color, marble chips cast in white Portland cement to produce a compressive strength of over 3000psi and reinforced with 16 gauge galvanized wire. Removeable type strainers are supplied. 1 1/4 inch tiling flange on 3 sides. Center drain.

#### 1.9.6.3 Laboratory Sink for POL Operations Center

Stainless steel, single bowl, self rim with holes for faucet and spout, single compartment 28 x 18 x 10 inches deep, seamless 20 gauge 302 stainless steel with full undercoat.

Faucet, Handles, and Spout - Single lever control with gooseneck faucet. Faucets shall meet the requirements of NSF 61, Section 9. Spout body, base, dome, and handles are chrome-plated brass. Faucet is protected from back siphonage by combination of two check valves and a vacuum breaker. Flow shall be limited to 0.16 liters per second (2.5gpm) at a flowing water pressure of 549kPa (80psig).

#### 1.9.6.4 Break Room Sink and Refrigerator Ice Maker for POL Operations Center

Self rim with holes for faucet and spout, double bowl, left compartment 14 x 15 3/4 x 10 inches deep, right compartment 14 x 15 3/4 x 7 inches deep with waste disposer drain opening, seamless 20 guage 302 stainless steel with full undercoat, right compartment equipped with food waste disposer. The food waste disposer shall contain a 3/4 horsepower motor with 2700rpm grinding action and delux sound insulation.

Faucet, Handles, and Spout - Single lever control with pullout retractable spray, Elkay model LK4330FCR or equal. Faucets shall meet the requirements of NSF 61, Section 9. Spout body, base, dome, and handles are chrome-plated brass. Faucet is protected from back siphonage by combination of two check valves and a vacuum breaker. Flow shall be limited to 0.16 liters per second (2.5gpm) at a flowing water pressure of 549kPa (80psig). Valves shall be thermostatic mixing type with pressure compensation.

Drain Assembly - Plug, cup strainer, crossbars, jam nuts, washers, couplings, stopper, etc., shall be copper alloy or stainless steel.

The refrigerator shall contain an icemaker domestic water hook-up

#### 1.9.6.5 Lavatory Sinks

Handles - Two lever type handles required, one for hot, and one for cold.

#### 1.9.6.6 Janitor Closet Sinks

A enameled cast iron floor mounted type service sink shall be provided in all janitor closets. Overall sink dimensions shall be approximately 28 inches x 28 inches. The depth of the floor sink bowl shall be approximately 10 inches.

#### 1.9.7 Storm Drainage

Where required storm drainage system shall include roof drains, overflow drains, leaders, and conductors within the building to a point 1.5 m outside the building. Where required by the architectural drawings, roof drains, with auxiliary overflow drains, shall be provided at the low points of the roof. Storm water shall be routed through interior downspouts and piped directly to the facility storm drainage system. Roof drains shall be designed for a maximum rainfall rate of 111 mm per hour and shall be sized in accordance with the International Plumbing Code (IPC). All elbows for the storm drainage and overflow drainage piping 10 inches and smaller shall be 90 degree short sweep elbows.

#### 1.9.8 Cathodic Protection

Cathodic protection shall be provided for any new underground ferrous piping, fittings, and valves except cast iron. Design of cathodic protection system shall in accordance with Section 01017 ELECTRICAL

REQUIREMENTS, paragraph entitled "Cathodic Protection".

#### 1.10 General Hydronic Systems.

System, equipment and calculation requirements listed below shall be required for the heating hydronic systems. The building distribution piping shall be direct return with automatic flow control valves. The material and installation requirements for items common to both systems shall be as specified in UFGS Section 15569A WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH.

##### 1.10.1 Flow Medium.

The hot water system designs shall include safeguards to protect against freezing damage. The flow medium for the hot water systems shall be a mixture 40% propylene-glycol.

##### 1.10.2 Computer Program or Spreadsheet.

The pressure loss, velocity and volume of each piping segment shall be calculated by a computer program/spreadsheet, based on the actual pipe, fitting, and valve material installed for each piping segment. The pressure loss calculations shall include the actual pressure loss through each valve such as control valves, triple duty valves, shut off valves, etc, based on the valve Cv. The designer shall show the valve Cv used in the hydronic calculations on the construction drawings. The computer program/spreadsheet shall calculate the pressure loss through each and every individual flow path of each system to determine the maximum pressure lost of the system. The computer program/spreadsheet shall also calculate the total system volume. A copy of all hydronic calculations, both input and output, shall be included in the design submittal.

##### 1.10.3 Piping

The hot and chilled water piping shall be as specified in UFGS Section 15569A WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH.

##### 1.10.3.1 Pipe Sizing Criteria.

The hydronic piping systems shall be sized to limit pressure loss and noise. Pipes 2 1/2 inches and larger shall be sized for a maximum pressure loss of 4 feet per 100 feet. Pipes 2 inches and smaller shall be sized for a maximum velocity of 4 feet per second.

##### 1.10.3.2 Piping Material.

All materials used for piping, valves and miscellaneous equipment shall meet or exceed the calculated design pressures, loads and stresses for each system. During design of the piping systems, consideration shall be given to future operations and maintenance activities. All systems shall be capable of being maintained with a minimal amount of disassembly of all assemblies and sub-assemblies. The technical specifications contain more than one possible material type. If the material type or valve Cv for any one piping segment is changed after the hydronic calculations for a given system have been calculated. The entire system shall be recalculated, as specified above, based on the actual materials installed and the pump shall be reselected.

##### 1.10.3.3 Piping Slope

All piping shall be pitched up in the direction of flow, shall be designed without pockets which would permit accumulation of air, and shall be provided with vents at high points and drains at low points. Piping located outside of mechanical equipment areas shall be routed in the attic or in the pipe chases. Slope of piping shall be as indicated in technical specifications.

#### 1.10.3.4 Pipe Expansion

In runs of pipe 50 feet and longer, or in shorter runs where designer deems it is required, indicate size on project drawings the location of all anchors, bends, loops, and pipe guides to adequately limit and provide for pipe expansion. Do not use expansion joints in piping unless absolutely necessary and justified. Anchors and guides shall be indicated on the project drawings and detailed for installation in the building structure provided. STRUCTURAL DESIGN ENGINEER shall be thoroughly informed of all forces generated.

#### 1.10.4 Coils and Terminal Equipment

Provide isolation valves, balancing valve, flow measuring device, and pressure/temperature test taps at all heating and/or cooling units, pumps, and hot water unit heaters. Pipe taps, suitable for use with temperature or pressure probe, shall be located at each pressure gauge. All coils shall be provided with valved drain and air vent connections. A thermometer shall be installed on the supply and return piping to/from each coil. All thermometers shall be legible to service mechanics standing at ground level. Temperature/pressure taps shall be provided on the supply and return piping of each coil. All three-way type control valves shall be provide with a balancing globe valve or cock in the bypass piping.

#### 1.10.5 Pumps.

Pumps and motors for hot water systems shall be properly sized for the application required. Pump capacity, efficiency, motor size, speed and impeller types shall be optimized for the application. Pump motor shall have the required capacity to prevent overloading with pump operating at any point on its characteristic curve. Pumps and motors shall operate at 1800 RPM (maximum).

#### 1.10.6 Expansion Tanks

A diaphragm type expansion tank shall be provided in the hot water piping systems. The expansion tank's precharge pressure and acceptance volume shall be selected based on the design of the piping systems. The STRUCTURAL DESIGN ENGINEER shall be thoroughly consulted before hanging any thing from the building structure.

#### 1.10.7 Air Separation Tanks

The hot and chilled water piping systems shall be provided with an air separation tank. The air separators shall include an automatic air vent and make-up water system, consisting of a pressure reducing valve, strainer, reduced pressure type backflow preventer and isolation valves.

#### 1.10.8 Water Treatment Systems

Provide a mixture of 40% propylene glycol and 60% water into the hot water

pipng systems. Provide a shot feeder (chemical feeder) at the hot water circulating pumps to allow introduction of chemicals into the system. Provide the chemical treatment necessary to protect the system equipment from damage due to corrosion.

#### 1.10.8.1 Chemical Treatment

The water shall be treated to maintain the conditions recommended by the boiler manufacturer. Chemicals shall meet required federal, state, and local environmental regulations for the treatment of boilers and discharge to the sanitary sewer. The services of a company regularly engaged in the treatment of boilers shall be used to determine the correct chemicals and concentrations required for water treatment. The company shall maintain the chemical treatment and provide all chemicals required for a period of 1 year from the date of occupancy. Filming amines and proprietary chemicals shall not be used. The water treatment chemicals shall remain stable throughout the operating temperature range of the system and shall be compatible with pump seals and other elements of the system.

#### 1.10.8.2 Make Up Water

The makeup water conditions reported per ASTM D 596 shall be as specified in Section 15569A WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH. Water softener and water analysis shall be as specified herein for makeup water. A water treatment plan shall also be provided as specified in accordance with Section 15569A WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH

#### 1.11 Hydronic Heating System for POL Operations Center and Refueler Maintenance Facility.

Gas fired radiant heat shall not be used in the Work Bays or Inspection Bay of the Refueler Maintenance Facility. Heating system for the Refueler Maintenance Facility (RMF) shall be hot water system with unit heaters in Work Bays and Inspection Bay, fan-coil units in heated only center areas. Heating system for the POL Operations Center shall be a forced-air/hot water system consisting of a natural gas fired boilers, water distribution system, circulating pumps, and associated space heating equipment. The hydronic heating system shall provide 100% of the buildings heating requirements for both space and ventilation loads. The use of electric resistance heating is not permitted. The heating system designs shall meet the requirements of UFGS Section 15569 WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH and, unless otherwise stated, shall comply with the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Handbooks and Terminology of HVAC&R guide. The hydronic heating system shall be heated by gas fired modular pulse condensing hot water boilers. The boilers shall be located in the mechanical room. The hot water heating system shall be circulated in a primary/secondary arrangement.

##### 1.11.1 Gas Fired Modular Pulse Condensing Hot Water Boilers.

Gas Fired Modular Pulse Condensing Hot Water Boilers shall be provided for the POL Operations Center and the Refueler Maintenance Facility as specified in Section 15569A, WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH. All boiler modules which serve the same building shall be of the same size. The boilers shall have a minimum rated efficiency of 90 percent with a return water temperature of 120 degrees F.

#### 1.11.2 Pulse Boilers Venting.

The boilers shall have a flue gas temperature low enough to permit side wall venting. Boiler vents shall be located through the side wall at approximately 28 inches above the finished grade. Maximum separation, as recommended by the boiler manufacture, shall be provided. The boilers shall be individually vented, both intake and exhaust, directly to the outside. Boiler vent exhaust fans shall not be provided. Boiler vents shall not be located on the front elevation of any building. Boiler vents shall be located as far from the front elevation of any building as practical.

#### 1.11.3 Hot Water Supply Temperature.

The system shall be controlled to reset the supply water temperature based on outside air temperature without the use of three-way valves at the boilers. The hot water system shall be designed for a maximum supply temperature of 150 degrees F, a maximum return temperature of 120 degrees F and a minimum return temperature of 80 degrees F. Since the boiler efficiency is an inverse function of the return water temperature, the hot water return temperature of 120 degrees F was selected by the Government to allow for maximum system efficiency. Deleted sentence. Sufficient coil capacity shall be provided.

#### 1.11.4 Hot Water Pumps.

Hot water centrifugal pump shall be as specified in Section 15569A, WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH. In addition to the boiler pumps required above, the building shall be provided with a hot water based-mounted centrifugal pump and standby pump for the hot water heating system. The pumps shall distribute hot water through the building distribution piping to the coils located in air handling units, blower coil units and unit heaters.

#### 1.11.5 Propeller Unit Heaters.

The mechanical and electrical equipment rooms shall be provided with a thermostatically controlled, hot-water, horizontal throw unit heaters to maintain a space temperature of 45 degrees F. minimum. Unit heaters shall be cycled from a space thermostat to maintain the space setpoint. Propeller unit heaters, as specified in Section 15569A, WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH, shall be provide to heat the mechanical rooms.

#### 1.12 POL Operations Center Control Room.

Communication rooms shall be provided with individual horizontal, ceiling hung, direct expansion type computer room or fan coil units for filtration, mechanical cooling, heating and pressurization. The unit shall transfer filtered relief air from the main ceiling plenum into the communication room to maintain the space under positive pressure. The unit shall be as specified in Section 15700A, UNITARY HEATING AND COOLING EQUIPMENT.

#### 1.13 Air Supply and Distribution Equipment.

This Section contains instructions and engineering requirements relating to the design of the new HVAC supply and distribution systems. The air supply and distribution system shall inculde all air handling equipment, fans, ductwork, hoods, etc. The design of all systems shall comply with the

American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Handbooks, Terminology of HVAC&R guide and to the requirements of NFPA Standards Nos. 90A. All HVAC systems shall be designed in accordance with NFPA for fire dampers, smoke dampers and fan shutdown. The designer shall show on the construction drawings all fire or smoke dampers required by NFPA. The materials and installation of the air supply and distribution system shall be as specified in Section 15895A, AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

1.13.1 Two-deck Multizone Air Handling Unit for POL Operations Center (POLOPS).

A portion of the POL Operations Center shall be heated & cooled by a two-deck (cold and hot) multizone air handling unit. All air handling unit components shall be located within the air handling unit. Coils shall be selected with no more than 500 feet per minute coil face velocity. To maintain outside air percentage less than 25% of the multi-zone supply, only a portion of the ventilation air required by ASHRAE standard 62 shall be supplied by the multizone AHU, with balance supplied by a blower coil.

1.13.1.1 Two Deck Multizone Module for POL.

Part or all of the AHU shall be manufacture's standard modular design or a custom design as required to provide a cold deck with cooling coil, and a hot deck with heating coil.

1.13.1.2 Two Deck Multizone Zone Control Dampers for POL.

There shall be one damper actuator per zone. Control dampers shall be as specified in Section 15951, DIRECT DIGITAL HVAC CONTROL SYSTEMS.

1.13.1.3 Filter Mixing Box.

A filter mixing box with 2 inch pleated filter shall be provided.

1.13.1.4 Return Air Plenum

A return air plenum shall be provided for the POL Operations Center with no air being returned from the Laboratory, Laboratory Office, or Toilet Rooms.

1.13.1.5 Access Sections.

The designer shall show access sections in the AHU where required to provide access for inspection, maintenance and/or control sensor installation.

1.13.1.6 Mandatory Space Zoning Requirements for POL

At least six multi-zone air handling unit zones shall be provided for the POL, and these are Office 116 (corner office), Office 115 plus Office 114, Classroom, Laboratory plus Lab Office, Break Room, and Ready Room plus Vestibule.

1.13.2 Exhaust Systems.

Except for wall mounted propeller units, all fans shall be centrifugal type and connected directly to weather-proof louvers using ductwork. Low leakage motorized dampers shall be provided. In-line fans located outside the main mechanical and electrical areas shall be the provided with a

manufacturers standard acoustical enclosure to inhibit noise transmission to the adjoining occupied spaces. Some value of fans measured 5 feet from fan inlet shall be less than 30 sones outside the mechanical equipment room. Sound transmission data shall be submitted for approval by the designer and acceptance at the governments option and design shall indicate noise criteria on schedules.

#### 1.13.2.1 Mechanical Electrical Rooms.

Exhaust or intake fan(s) shall be provided in the mechanical and electrical rooms for summer ventilation as specified above. Intake fans shall be provided when the mechanical room contains gas burning equipment that is not directly vented to the outdoors for both combustion air and combustion by-products. Sidewall mounted fans with exterior louvers shall be provided. The fans shall be controlled by a space mounted thermostat to cycle the fans on when the space temperature rises above 85 degrees F.

#### 1.13.2.2 Toilets.

The restroom exhaust shall be provided through inline exhaust fans, duct systems, and louvers directly to the exterior. Each set (male and female) of restrooms shall be provided with an individual inline centrifugal fan. Exhaust fans shall be provided with a single speed motor.

#### 1.13.3 Duct Systems Calculations.

The velocity and total pressure loss, both velocity and static, of each duct segment shall be calculated by a computer program/spreadsheet, based on the equal friction method or by T-method Optimization as described by ASHRAE. The computer program/spreadsheet shall calculate the pressure loss through each duct segment for each and every individual flow path and determine the maximum pressure loss of the system. The computer program/spreadsheet shall perform calculations based on the actual material installed. A copy of all duct calculations, both input and output, shall be included in the design submittal.

##### 1.13.3.1 Duct Pressure Classification

The designer shall indicate the duct pressure classification for each duct segment on the construction drawings. All ductwork shall be sealed to seal class A.

##### 1.13.3.2 Diffusers, Registers and Grilles.

Supply diffusers and registers shall be sized for a maximum total pressure (velocity and static) loss of 0.15 inches w.g. and a maximum noise criteria (NC) of 30. Return, exhaust and relief registers and grilles shall be sized for a maximum total pressure (velocity and static) loss of 0.1 inches w.g. and a maximum noise criteria (NC) of 20. Diffusers, registers, and grilles in humid areas shall be aluminum or stainless steel for corrosion resistance.

##### 1.13.3.3 Supply Duct Systems Maximum Friction Rate.

Supply duct friction rate for the equal friction method shall not exceed 0.08 inches w.g. per 100 feet.

##### 1.13.3.4 Return and Exhaust Duct Systems Maximum Friction Rate.

Exhaust duct friction rate for the equal friction method shall not exceed 0.08 inches w.g. per 100 feet.

#### 1.13.3.5 Positive Pressure Duct Velocity.

Except for relief duct and openings, the maximum velocity for ductwork under positive pressure shall be limited as specified below. Building relief duct and openings shall be sized for a maximum velocity of 300 feet per minute.

a. Areas with Exposed Ductwork. For areas with exposed ductwork or dustwork above an open grid type ceiling, the maximum main air duct velocity shall be 1200 feet per minute for rectangular duct and 2200 feet per minute for round duct. Branch air ducts maximum velocity shall be 80 percent of the velocity values specified above for main air ducts. The maximum velocity for runouts to outlets shall be 50 percent of the velocity values specified above for main air ducts.

b. Areas with Gypsum Ceilings. For ductwork located within the ceiling space above a gypsum ceilings, the maximum main air duct velocity shall be 2000 feet per second for rectangular duct and 2500 feet per second for round duct. Branch air ducts maximum velocity shall be 80 percent of the velocity values specified above for main air ducts. The maximum velocity for runouts to outlets shall be 50 percent of the velocity values specified above for main air ducts.

c. Areas with Acoustical Ceilings. For ductwork located within the ceiling space above a acoustical ceilings, the maximum main air duct velocity shall be 1500 feet per minute for rectangular duct and 2500 feet per minute for round duct. Branch air ducts maximum velocity shall be 80 percent of the velocity values specified above for main air ducts. The maximum velocity for runouts to outlets shall be 50 percent of the velocity values specified above for main air ducts.

#### 1.13.3.6 Negative Pressure Duct Velocity.

For ductwork under negative pressure the maximum velocity shall be limited to 80 percent of the value specified above for positive pressure ductwork except that transfer air openings and return air openings from return air plenums shall be sized for a maximum velocity of 300 feet per minute. Return air openings from return air plenums shall be with bell-mouth type entrances into the return duct system.

#### 1.13.3.7 Duct Fitting Pressure Loss Coefficients.

Pressure loss through ductwork fittings shall be determined utilizing both methods and coefficients as presented in the ASHRAE Duct Fitting Database. Fitting types that are not part of the ASHRAE Duct Fitting Database shall not be designed provided or installed. The designer shall show, on the drawings, the fitting type used in the system calculations.

#### 1.13.4 Ductwork Componets.

##### 1.13.4.1 Acoustical Duct Liner.

Acoustical Duct Liner shall not be provided. To the maximum extent

possible, objectionable sound shall be attenuated through the design and layout of the duct system. If required to control objectionable noise, sound attenuators shall be provided as specified in Section 15895A, AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

#### 1.13.4.2 Moist Exhaust Ducts.

Exhaust ductwork serving high moisture areas, such as shower areas, shall not be routed through unconditioned spaces and shall be sealed water tight and constructed of stainless steel or welded aluminum.

#### 1.13.4.3 Duct Drainage

Outside air intake louvers, louvered penthouses and moist exhaust ducts specified above shall be ducted and shall have provisions to dispose of melted snow, wind-blown rain and condensate which enters through the louvers or condenses in the duct. The duct seams shall be sealed watertight by soldering, brazing or welding and a drain provided at the duct low point. The drain shall be routed to a floor drain in a non-finished area such as the mechanical room. Duct access doors shall be provided near the louvers and drains.

#### 1.13.4.4 Fire Dampers.

Fire dampers shall be provided as required by NFPA 90A and 90B. The designer shall show, on the construction drawings, all fire dampers as required by NFPA 90A and 90B. The pressure loss resulting from a full open fire damper shall be included in the system calculations specified above.

#### 1.13.4.5 Manual Balancing Dampers.

Manual balancing dampers shall be provided at all branch take-offs in duct systems to permit adequate opportunity for balancing the system. Balancing dampers shall be located within 12 inches of the main duct. Splitter type dampers or air deflectors which project out of the branch and into the main duct shall not be provided. The designer shall show, on the construction drawings, all balancing dampers. The pressure loss resulting from a full open balancing damper shall be included in the system calculations specified above.

#### 1.13.4.6 Manual Zone Balancing Dampers.

Manual zone balancing dampers shall be provided on each zone's main duct at the multizone AHU. These dampers shall be located within the mechanical room and within 3 feet vertically from the discharge of the AHU. The designer shall show, on the construction drawings, all balancing dampers. The pressure loss resulting from a full open balancing damper shall be included in the system calculations specified above.

#### 1.13.4.7 Louvers.

Fixed blade louvers shall be located where exhaust fans and relief dampers discharge from the building and where outside air is brought into the building. Motorized dampers shall be provided at all duct penetrations of the building envelope to prevent loss of energy. Relief louvers and dampers (both a motorized and a backdraft per louver) shall be provided as specified above.

#### 1.13.4.8 Cold Air Diffusers.

When the leaving air temperature for the cooling coil is below the dew point temperature of the space, diffusers designed for diffusion of cold air below 50 degrees F shall be provided. The designer shall clearly indicate on the construction drawings which diffusers are required to be cold air diffusers.

#### 1.14 HVAC Controls.

Design of the Direct Digital Controls (DDC) for the various HVAC systems shall be included as part of the system design. Direct Digital Controls shall be as specified in Section 15951, DIRECT DIGITAL HVAC CONTROL SYSTEMS. The designer shall use the same basic format (symbols, nomenclature and identifiers) as shown in TI 810-11 for Single Loop Digital Controls.

##### 1.14.1 Permanent Maintenance Instrumentation

Provide sufficient instrumentation to aid maintenance personnel in balancing and/or troubleshooting mechanical systems. Instrumentation shall be provided in the media at each change in temperature and at all mixing points in air handling systems, at all discharges of air handlers, and at all return mains. Pressure gauges, thermometers, flow indicators, sight glasses, etc., shall be installed to be easily read from the adjacent floor. Separate pressure gauges shall be installed on both the suction end and discharge end of pumps. Provide an isolation valve on all pressure gauges. Thermometers shall have separable socket thermo-wells. Allow for the removal, repair, or cleaning of flow measuring devices without having to shut down the system. Provide a portable meter, with appropriate range, for each type of flow measuring device installed.

##### 1.14.2 EMCS Connection .

The contractor shall provide programming to construct new graphical interfaces at central operators console located in the building specified by the Contracting Officer's Representative. The contract shall provide software all hardware as required to connect the facility to the existing McConnell AFB Barber Coleman basewide centralized Energy Monitoring and Control System (EMCS).

##### 1.14.2.1 Power Outage Start-Up

Upon an electrical power outage, all air handling units, pumps, and other major mechanical equipment shall shut down and shall be restarted in a logical and efficient manner. Timing between starts and sequence of equipment starting upon restoration of electrical power shall be provided and programmed into the HVAC temperature control system, with programming capable of being changed by the operating personnel.

##### 1.14.2.2 Local Space Temperature Control

Control of local space temperature setpoints shall be under control of the EMCS.

##### 1.14.2.3 Freeze Protection

Standard type freeze stats shall not be provided. The equipment is protected from freezing by the glycol mixture of the heating and cooling fluids. The control systems shall send an alarm through the EMCS and shut

down the equipment when an averaging type sensor reports the delivery of air at a freezing temperature from any system within the facility. The equipment shall be restartable at both the local control panel and by the EMCS. Low temperature averaging safety sensors shall be as specified for other averaging type sensors in the air stream and may or may not be required to preform another control function.

#### 1.14.3 Construction Control Drawings.

As a minimum, the designer's construction control drawings shall include a system schematic (following the format and symbology contained in TI 810-11), the sequence of operation, a table of all digital and analog inputs and outputs (points), all control valve Cv's, and wiring diagrams for all motor starters. The above information shall be provided for each and every distinct mechanical system.

##### 1.14.3.1 System Schematic.

The system schematic shall identify all system sensors, indicators, actuators, pressure switches, gages, etc, and all major mechanical components such as fans, filter banks, dampers, coils, and control valves. An indicator shall be shown and installed everywhere a sensor is shown and installed for troubleshooting purposes. Separate stem type thermometers shall be required at the inlet and outlet of all hot water coils, all chilled water coils, and all dry cooler coils.

##### 1.14.3.2 Sequence of Operations.

The sequence of operation shall be completed by the designer and shall be as specified in Section 15951, DIRECT DIGITAL HVAC CONTROL SYSTEMS. The designer shall modify all setpoints in the sequence of operation as required to match the final design of the system.

##### 1.14.3.3 Input and Output Table.

The table of all digital and analog inputs and outputs shall, at a minimum, include function, setpoint and any appropriate remarks.

##### 1.14.3.4 Control Valve Cv Table.

The table of all control valve Cv's shall, at a minimum, include each control valve's unique identifier, function, type, range and minimum required Cv. The control valve Cv shown here shall be the Cv used in the hydronic pressure loss calculations specified above.

##### 1.14.3.5 Wiring Diagrams.

The wiring diagrams shall, at a minimum, show the source of power; control transformers (as necessary) including primary and secondary voltages; grounding; overcurrent protection; overload protection; safety devices; and all control contacts and switches. The diagrams shall be coordinated with the requirements of Section 16415A, Electrical Work Interior. All control voltages shall not be more than 120 volts to ground. All three-phase motors over 1 horsepower shall be wired with phase failure relay in the motor starter.

#### 1.14.4 Control Panels.

The DDC HVAC panel shall be located in the mechanical room.

#### 1.14.5 Package Equipment.

Package equipment, such as boilers and chillers, shall be provided with standard manufacture's DDC controls for each individual piece of equipment.

##### 1.14.5.1 Boilers.

Each boiler shall accept a start/stop signal from the HVAC control system and shall provide a unit failure signal to the HVAC control system.

#### 1.15 MILITARY FUEL PUMPS GENERAL INFORMATION

All work shall conform to MIL-HDBK-1022A, Petroleum Fuel Facilities, UFC 3-600-01, Fire Protection Engineering for Facilities, Industrial Ventilation by ACGIH, and other references listed in this section. Four fuels will be dispensed which are ethanol, bio grade diesel fuel B-20, normal diesel fuel, and MOGAS (unleaded regular gasoline). Existing above ground storage tanks will contain the two diesel fuels, and the existing underground tanks will contain the ethanol and MOGAS. Installation must comply with federal, state, and local government regulations that are in effect at a particular facility. This contract may be more stringent than the previously mentioned standards because all pipe must be double wall type with leak detection devices monitored at the POL Operations facility constructed under this contract. However, where this contract is less stringent than MIL-HDBK-1022A, UFC 3-600-01, ACGIH, or federal, state, and local government regulations, these standards and regulations shall take precedence over this contract. See civil sheet CG2.6 and mechanical demolitions sheets contain photographs of existing facilities.

This contract includes installation of two ground vehicle fuel dispensing units located as shown on the architectural plans, each dispensing unit containing two nozzles (four total nozzles), with fuel pumps located remotely at the existing storage tanks. Each of the four fuels being dispensed (ethanol, MOGAS, and two grades of diesel), from four existing remote fuel storage tanks, will be dedicated to one nozzle. These remote tanks, which are shown on the civil drawings, are two aboveground Tanks 3 and 4, and two underground tanks 7 and 8.

Also, four 25gpm pumps, each dedicated to one of the four fuels, will be required near the aboveground tank, or submerged in the underground tank, and serving the remote ground vehicle fuel dispensing units. Two of these pumps will be submersible installed in the existing underground tanks, one in underground tank number 7, and one in underground tank number 8, located approximately as shown on the civil and mechanical sheets. Assume that no provisions have been made in these existing underground tanks for insertion of these two submersible pumps. The remaining two pumps will be mounted outside on the ground near the above ground tanks, one serving tank 3, and the other tank 4.

In addition, one 300 gpm bulk loading, and one 300gpm bulk unloading, aboveground pumps shall be added at the tank farm. At the tank farm (location of subject tanks 3, 4, 7, and 8), are bulk loading and unloading equipment for tank trucks. For the aboveground tanks 3 and 4, there are two existing pumps, one for loading, and the other for unloading tank trucks, with existing pipe and valves controlling connections to either tank 3 or tank 4. Two additional 300gpm pumps must be installed, one for loading, and one for unloading, tank trucks. Each tank will be re-piped with a dedicated loading and unloading pumps, and independent piping, for each of

tank 3 and tank 4.

All piping serving the ground vehicle dispensing units from the four existing storage tanks, and the bulk loading and unloading header stations serving the four existing storage tanks, shall be new with leak detection monitoring, with existing underground pipe abandoned or removed, and existing aboveground pipe removed, as required by applicable codes or regulations. For bulk loading, unloading, and ground vehicle dispensing units, the piping system shall be changed so that each of the four fuels have independent dedicated piping without possibility of contamination of one fuel by the other. Thus four separate pipes are required, routed mostly underground, double wall monitored from the tanks to the new ground vehicle dispensing units, one dedicated fuel pipe run per nozzle. New aboveground pipe is required carrying fuel over the dikes serving aboveground tanks from bulk tank truck unloading station, through pump, and to tank 3. Re-use existing pump, related components, and unloading station. Also, for tank 4 new aboveground pipe is required similar to tank 3, but new pump, unloading station, and all related components area required, similar to existing. New tank truck loading pipes are required, double walled monitor type for underground pipes, and aboveground pipe shall be over existing dikes and monitored, is required from tanks 3 and tank 4, through pumps, to truck loading stations. For tank 3, existing pump and truck loading header station can be re-used, but will be dedicated to tank 3. For tank 4, a new pump with related components as stated, and the existing second truck loading header station can be used but must be re-pipe so that it is dedicated to tank 4 without contamination from tank 3 fuel. The existing submersible bulk truck load pumps for each of tanks 7 and 8 will not be part of this contract.

All four fuel storage tanks shall be cleaned after installation is complete. Modify these aboveground and underground tanks to meet standards listed in this specification section.

## 1.16 MILITARY FUEL PUMPS

### 1.16.1 PUMPS, LOADING, OFF LOADING EQUIPMENT AND HEADER STATIONS FOR EXISTING ABOVEGROUND TANKS 3 AND 4

Provide one 300 gpm centrifugal bulk tank truck unloading pump and related equipment configured for automatic air elimination to serve aboveground Tank 4, and existing pump will serve only Tank 3. Locate pump in underground covered vault with proper depth to meet net positive suction head requirements. Install fuel system pump components required by MIL-HDBK-1022A, including that specified in paragraph 3.3.2.3, and shown on Facility Plate No. 003, including flexible pipe joints at pump connections, isolation valves, strainer, flow switch, gauge, and surge check valve, and similar to existing installation to serve tank 3. The new pump shall be equal to the existing pump which is Gorman Pump, Mansfield OH, RD3A31-BAR, 7 5/8 inch impeller, 1154579N, US Electric Motor 40 HP, 3ph, 60hz, except it must conform to MIL-HDBK-1022A and provide 300gpm.

Provide one 300gpm truck loading pump to serve aboveground Tank 4, and existing pump to serve only Tank 3. Install fuel system pump components required by MIL-HDBK-1022A, including flexible joints, isolation valves,

fuel meter, and surge check valve. The new pump shall be equal to the existing pump which is Byron Jackson Pumps, BW/IP Internation Inc., serial number 97ER1740, model TP-4, 300gpm, 112feet head, 3600rpm, 1000psi test pressure, 667mwp, 15hp, 460volts ac, except it must conform to MIL-HDBK-1022A.

Provide two 25 gpm pumps serving remote ground vehicle dispensing units, one dedicated to tank3, and the other dedicated to tank 4, each to be activated by dispenser nozzle removal, each with fuel system pump components required by MIL-HDBK-1022A, including flexible joints, isolation valves, fuel meter, and surge check valve. Pumps shall conform to API Std 610, Appendix A, except as modified herein. Mechanical seals within the pump shall be Buna-N or Viton. Pump casing, bearing housing, and impellor shall be stainless steel ASTM A 743/A 743M GR CF8M or GR CA6NM or aluminum ASTM A 356/A 356M GR T6. Pump shaft shall be stainless steel ASTM A 276 Type 410 or 416. Pump baseplate shall be of cast iron construction. Internal pump components in direct contact with the fuel to be handled shall be of compatible construction. Pump assembly shall be statically and dynamically balanced for all flow rates from no flow to 120 percent of design flow. Pump bearings shall be selected to give a minimum L-10 rating life of 25,000 hours in continuous operation. Pump shall be driven by an explosion-proof motor for Class I, Division 1, Group D hazardous locations as defined in NFPA 70. Pump shall be accessible for servicing without disturbing connecting piping. Pump control panel shall include on and off indication lights for each pump. The panel shall contain an adjustable control logic for pump operation in accordance with the indicated operation. The panel shall also have a manual override switch for each pump to allow for the activation or deactivation of each pump. Panel, except as modified herein, shall be in accordance with Section 16415A ELECTRICAL WORK, INTERIOR. Pump shall be the in-line, split-case, double suction, single stage, self-priming, centrifugal type. Pump motor shall be mounted horizontal to the pump housing and be provided with flanged end connections.

#### 1.16.2 SUBMERSIBLE PUMPS FOR EXISTING UNDERGROUND TANKS 7 AND 8

Provide two submersible dispensing pump, one for each underground tank to serve the new ground vehicle dispensing units, to be activated by dipenser nozzle removal. The submersible pumps to be located in the existing product storage tanks. Pump and motor combination shall operate efficiently totally submerged in product of storage tank. When pump only is submerged, pump shall be driven by explosion-proof motor for Class I, Division 1, Group D hazardous locations as defined in NFPA 70. Each pump shall have delivery capacity of 25 liter per second at a total discharge head to be determined by the designer. Install on discharge side of each pump, an approved leak detection device which will provide indication when piping between tank-mounted pump and dispensers are not liquid-tight. Pump inlet shall be horizontal. Provide clearance of not less than 127 mm nor more than 178 mm between bottom of tank and end of pump. Pump shall be a single- stage vertical pump and extend inside the tank to within 150 mm of the striker/impact plate. Pump and motor combination shall operate totally submerged in the product of the storage tank. Pump fuel inlets shall be horizontal. Pump, motor, and column pipe assemble shall mount through a NPT pipe penetration in a tank's manway cover. Pump mounting shall completely support both the weight and vibration of the pump. The unit shall be provided with a steel lifting lug capable of supporting the weight of the entire pump and motor assembly. Pump shall include a vertical solid shaft motor, base mounting flange, horizontal pump discharge, low net positive suction head (NPSH) first stage impellers, dynamic and thrust

balancing of impellers, and a stainless steel one piece pump shaft. Pump shall be provided with flanged end piping connections.

#### 1.17 CLEANING OF EXISTING FUEL STORAGE TANKS

The two existing above ground tanks number 3 and 4, 70,000 gallons each, and the two underground tanks, 10,000gallons each, shall be cleaned after all work is complete in accordance with MIL-STD-1022A and American Petroleum Institute API 2015. Existing Tank 7 contains de-icing solution.

#### 1.18 MILITARY FUEL PUMPS PIPING

##### 1.18.1 Piping General

Route four underground pipes from each pump serving the four fuel storage tanks to the new ground vehicle dispensing unit. Use double wall fiberglass re-inforced pipe with leak detection system monitored by the POL Operations Center. Piping routinely carrying fuel shall be fiberglass reinforced plastic (FRP) or stainless steel as defined herein.

##### 1.18.2 Secondary Containment Piping for Outside Tank 3 and 4 Containment Area

All piping installed shall be secondarily contained, unless otherwise indicated. Piping system shall be of double-wall construction with the internal pipe being the product pipe and the exterior pipe being an fiberglass reinforced plastic containment pipe as defined herein. Piping system shall be a factory manufactured piping system designed in accordance with ASME B31.3 and NFPA 30. The containment piping shall allow for complete inspection of the product piping before the containment piping is sealed. Containment piping shall be chemically compatible with the type of fuel to be handled. Containment piping shall be non-corrosive, dielectric, non-biodegradable, and resistant to attack from microbial growth. Containment piping shall be capable of withstanding a minimum 35 kPa air pressure. Containment piping shall be evenly separated from the primary pipe using pipe supports which are designed based on pipe size, pipe and fuel weight, and operating conditions. The supports shall be constructed of the same material as the primary pipe and shall be designed so that no point loading occurs on the primary or exterior pipe. Supports shall be permanently attached to the product pipe either by tack welding or by an adhesive. The exterior piping and supports shall allow for normal draining as well as the installation of any necessary leak detection equipment or cables. Supports shall be designed and installed to allow for pipe movement of both the product piping and the exterior piping without causing damage to either. Containment piping shall be capable of withstanding H-20 highway loading as defined by AASHTO HB-16.

##### 1.18.3 Fiberglass Reinforced Plastic (FRP) Pipe

###### 1.18.3.1 Pipe

Pipe shall be compatible with the fuel to be handled and be in accordance with ASTM D 5677. Pipe shall be compatible with the fluid being transported. Use of FPR piping is limited to buried service only and at pressures not exceeding that marked on the pipe.

###### 1.18.3.2 Fittings

Fittings and joining materials shall be in accordance with ASTM D 5677.

Threaded fittings shall not be used for product piping in inaccessible locations. Fittings for secondary exterior pipe of double-wall piping system shall accommodate the primary inner pipe and any additional equipment required, such as leak detection cables. Fittings and joining materials shall be compatible with the fuel to be handled.

#### 1.18.4 Stainless Steel Pipe

Stainless steel pipe 150 mm or smaller shall be in accordance with ASTM A 312/A 312M Schedule 40, Type TP304L, seamless only. Longitudinally welded 150 mm pipe also can be provided if made in accordance with the procedures in ASTM A 358/A 358M with wall thickness of 6.4 mm. Stainless steel pipe larger than 150 mm shall be in accordance with ASTM A 312/A 312M Schedule 10S, Grade 304L, seamless only or ASTM A 358/A 358M Grade 304L, Class 1 or 3, welded with wall thickness no less than 6 mm for pipe 300 mm and smaller, and 8 mm for pipe larger than 300 mm.

##### 1.18.4.1 Connections

Connections for pipe smaller than 65 mm shall be forged, socket weld type, Type 304 or 304L, 2000 W.O.G. conforming to ASTM A 182/A 182M and ASME B16.11. Connections for pipe 65 mm and larger shall be butt weld type conforming to ASTM A 403/A 403M, Class WP, Type 304L, seamless or welded, and ASME B16.9 of the same wall thickness as the adjoining pipe. Piping in inaccessible locations, such as product piping inside of containment piping, shall be welded.

##### 1.18.4.2 Welding Process and Electrodes

The welding process for stainless steel piping shall be a gas tungsten arc or gas metal arc process in accordance with ASME B31.3. Welding electrodes shall be E308L conforming to AWS A5.4.

##### 1.18.5 Valves

Portions of a valve coming in contact with fuel shall be compatible with the fuel to be handled. Valves shall have bodies, bonnets, and covers constructed of stainless steel conforming to ASTM A 743/A 743M, Type 304 or 316; or aluminum alloy conforming to ASTM B 26/B 26M, Type 3003, 6061-T6, or 356-T6. Each valve shall have stainless steel stem and trim. Valves shall be suitable for a working pressure of 1900 kPa (275 psig) at 38 degrees C with a weatherproof housing and be provided with flanged end connections unless indicated otherwise. Seats, body seals, and stem seals shall be Viton or Buna-N.

##### 1.18.6 Piping

Piping shall be inspected, tested, and approved before burying, covering, or concealing. Piping shall be installed straight and true to bear evenly on supports. Piping shall be free of traps, shall not be embedded in concrete pavement, and shall drain toward the corresponding storage tank. Any pipe, fittings, or appurtenances found defective after installation shall be replaced. Piping connections to equipment shall be as indicated or as required by the equipment manufacturer. Pipe and accessories shall be handled carefully to assure a sound, undamaged condition. The interior of the pipe shall be thoroughly cleaned of foreign matter and shall be kept clean during installation. The pipe shall not be laid in water or stored outside unprotected when weather conditions are unsuitable. When work is not in progress, open ends of pipe and fittings shall be securely closed so

that water, earth, or other substances cannot enter the pipe or fittings. Cutting pipe, when necessary, shall be done without damage to the pipe. Pipe shall be reamed to true internal diameter after cutting to remove burrs. Changes in pipe sizes shall be made through tapered reducing pipe fittings. Stainless steel pipe shall in no case be welded directly to carbon steel pipe. Cutting of FRP pipe shall be performed with a hacksaw or circular saw. Fuel supply piping from a storage tank shall extend to within 150 mm of the tank's bottom.

1.18.6.1 Aboveground Piping

Pipe sections shall be installed as indicated and be complete prior to performing any piping tests. FRP shall not be used aboveground.

1.18.6.2 Belowground Piping

Nonmetallic pipe shall be installed in accordance with pipe manufacturer's instructions. Belowground piping shall be laid with a minimum pitch of 25 mm per 6 m. Horizontal sections of pipe shall be installed with a minimum of 450 mm of backfill between the top of the pipe and the ground surface. The full length of each section of belowground pipe shall rest solidly on the pipe bed. Joints in secondary piping shall not be made until inner pipe is successfully pressure tested.

1.18.6.3 Pipe Hangers and Supports

Seismic requirements shall be in accordance with Sections 13080, SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 15070A SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT. Additional hangers and supports shall be installed for concentrated loads in piping between hangers and supports, such as for valves. Miscellaneous steel shapes as required shall be installed in accordance with ASTM A 36/A 36M. Pipe supports shall be installed in accordance with MSS SP-58 and MSS SP-69. Pipe spacing shall be as follows:

Nominal Pipe Size (mm)	25 and Under	40	50	80	100	150	200	250	300
Maximum Hanger Spacing (m)	2.1	2.7	3	3.7	4.3	5.2	5.8	6.7	7.0

1.18.6.4 Pipe Sleeve

Piping passing through concrete or masonry construction shall be fitted with sleeves. Sleeve shall be of sufficient length to pass through the entire thickness of the associated structural member and be large enough to provide a minimum clear distance of 13 mm between the pipe and sleeve. Sleeves through concrete shall be 0.91 mm steel, fiberglass, or other material as approved by the Contracting Officer. Sleeves shall be accurately located on center with the piping and securely fastened in place. The space between a sleeve and a pipe shall be caulked and sealed as specified in Section 07900A JOINT SEALING. In fire walls and fire floors, both ends of a pipe sleeve shall be caulked with UL listed fill, void, or cavity material.

1.18.6.5 Pipe Anchor

Where steel piping is to be anchored, the pipe shall be welded to the structural steel member of the anchor and the abraded area shall be patched with protective coating or covering as specified.

## 1.19 MILITARY FUEL PUMPS PIPING LEAK DETECTION MONITORING SYSTEM

Where conflicts exist between this section and the electrical section, the electrical section shall govern. Provide continuous surveillance leak detection system suitable for operation in an NFPA 70, Class 1, Division 1, Group D environment and located in the leak containment space between interior and exterior walls of double-wall piping. System shall detect leakage into containment space by monitoring interstitial pressure, vacuum variations, or sense hydrocarbon vapors electronically. Sensor output and transmission shall be electronic. Sensors shall be compatible with and detect leakage of materials stored in pipe at a rate of 0.105 milliliter per second with 95 percent probability of detecting this size leak and five percent probability of declaring pipe leaking at this rate when, in fact, it may be leaking less as well as ground water which may leak through secondary containment. Panel shall be in a NEMA enclosure suitable for the environment and have an audible and visual alarm for each zone and include acknowledgement switch and rechargeable battery backup capable of operating the system continuously for a minimum of 48 hours. Panel shall incorporate self-test system which permits operator verification of proper operation of leak detection equipment. Mount panel in POL facility as indicated. Enclose underground cable in PVC coated conduit. Provide instructions and equipment required for calibration of leak detection system and manufacturer's recommend calibration maintenance schedule.

## 1.20 FUEL DISPENSING UNITS FOR GROUND VEHICLES

For ground vehicles, two dispensing units are required each with two hose outlets, and shall be located on island shown on civil and architectural drawings. When fuel pump nozzle removed, card key entered at pedestal, and subsequent approval is obtained, then respective remote tank fuel pump will start. Each nozzle will be dispense only one type of fuel and will be piped separately from the remote fuel storage tank and pump. These four nozzles will be located on two dispensing unit enclosures on an island as shown, allowing four vehicles to fuel simultaneously.

Each dispensing unit shall be computer controlled, lighted, double sided, remote type, with two hose outlets each suitable for single product delivery flow rate of 0.76 liter per second from each nozzle. Steel frame shall be capable of resisting normal vertical and lateral loads and secured to dispensing island with at least two 15 mm anchor bolts. Exterior panels shall be either stainless steel or steel with baked enamel finish, or combination of the two. Provide manufacturer's standard microprocessor which has the following functions:

- a. Totalizer: Eight-digit (999,999.99) electronic totalization with identification for each product volume in liters.
- b. Filters: Replaceable filter element on each product line with a nominal filtration efficiency of 0.025 mm with a flow rating equal to the rate of the dispensing unit.

- c. Backup: Battery backup with automatic charging circuits to hold data for a minimum of three months without recharging.
- d. Accessories: Equip each assembly with accessories such as built-in air eliminators, line check valves, and emergency shut-off valve. Install centering ring or stabilizer bar to ensure proper shearing action for emergency shut-off valve if the dispensing unit is knocked from it's supports.
- e. Interlocks: Units shall include nozzle supports interlocked to pump motor control switch to start and stop the pump by nozzle removal and replacement. Provide each unit with interlock switch and valve arrangement that prevents flow of product until meter is reset after dispensing nozzle is returned to holder.
- f. Hose: Provide dispensing hose conforming to UL 330, gasoline and oil resistant, statically grounded, flexible in sub-zero temperatures. Provide a minimum of 3.70 meters of hose for each product line on the dispenser. Provide each hose with spring loaded cable to return device attached near mid-length of hose.
- g. Nozzles: Dispensing nozzles shall be automatic shutoff type, without latch-open device, aluminum body, and full hand insulator to prevent splash-back.
- h. Breakaway device: Provide each product hose with UL listed emergency breakaway device designed to retain liquid on both sides of breakaway point. Breakaway device shall have pressure balancing chamber to override line pressure to prevent nuisance breaks caused by a restriction in delivery hose diameter.

## 1.21 MILITARY FUEL PUMPS BULK FUELING LOADING AND UNLOADING HEADER STATIONS

### 1.21.1 Loading and Unloading Header Stations, General

To serve aboveground existing tank 4, install new tank truck bulk loading and unloading (off loading) equipment in accordance with MIL-STD-1022A, including requirements in paragraphs 3.4.2 and 3.3.2.3 and Facility Plate 003, similar to existing loading and unloading stations to be re-piped and dedicated to tank 3, with two each off loading fueling hoses (four total hoses, two serving each tank unloading station). The new station shall contain a check valve and strainer for each hose. Replace deicing truck loading header station by providing new hose for existing underground tank 7 and associated piping for arrangement similar to tank 8, and in accordance with MIL-HDBK-1022A.

### 1.21.2 Fueling Hose

Hose shall be in accordance with API Std 1529, Grade 3, Type A or C, semi-hardwall. Hose shall be compatible with the specified fuel and withstand a working pressure of 2070 kPa (300 psig) . Hose shall be constructed of braided synthetic cord surrounded by an interior rubber tube and an exterior rubber cover. Each fueling hose shall be provided with a

stainless steel hose tray. The hose tray shall provide support for the entire length of the fueling hose, allow for draining of rainwater, support the fueling hose at the height indicated, protect the hose from the sun's ultraviolet rays, and allow for easy insertion and removal of the fueling hose.

1.22 Miscellaneous Requirements.

1.22.1 Hydraulic Lift for Refueler Maintenance Facility (RMF)

A 75,000 lbs hydraulic lift is required in one Work Bay of the Refueler Maintenance Facility with hydraulic pump and reservoir located outside. See architectural floor plan for details.

1.22.2 Wash Bay Equipment for Inspection Bay of Refueler Maintenance Facility (RMF)

Provide wash bay equipment as required. See architectural plan for location.

1.22.3 Air Compressor and drops for Refueler Maintenance Facility (RMF)

Provide are compressor designed for outside installation, 125psig with 80 gallon receiver, and compressor capacity equivalent to Ingersoll Rand model 2545 located in the existing facility. See architectural plan for location. Provide compressed air drops in Tool Room, Inspection bay, and two per stall in Work Bay (between each door).

1.22.4 Vacuum Pump and Hood for POL Operations Center Laboratory

Provide hood equivalent to Iroquois Hoods except meeting 29 CFR 1910.1450 and MIL-HDB-1022A, 2100 Burton Street, 40inches x 32inches high x26inches deep, 816-726-5971. Provide vacuum pump capable of 25inches of mercury in the laboratory for the POL facility hood, ¼ hp motor, equivalent to Vacuum System Inc. model IPC-2, serial number 5112.

1.22.5 Ventilation of the POL Operations Center Laboratory and Lab Office

The Laboratory, and Lab Office, shall exhausted to maintain a negative room pressure between each of these rooms and adjacent areas (Laboratory and Lab Office may be neutral to each other). Room air from the Laboratory and Lab Office shall not be re-circulated to other building areas. Ventilation shall conform to the ACGIH manual, MIL-HDBK-1022A, and other relevant standards.

PART 2 NOT USED.

PART 3 NOT USED

-- End of Section --

## SECTION 01017

## ELECTRICAL REQUIREMENTS

**[03/01]**

PART 1 GENERAL Electrical requirements described in this section are for Refueler maintenance, service station, and POL buildings. Attachment sketch #1 to this section describes Service station electrical requirements.

## 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.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEES C2 (1997) National Electrical Safety Code

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2002) National Electrical Code (NEC)

NFPA 72 National Fire Alarm Code

NFPA 75 (1999) Standard for the Protection of Electronic Computer/Data Processing Equipment

NFPA 101 (2000) Safety to Life from Fire in Buildings and Structures

NATIONAL ASSOCIATION OF CORROSION ENGINEERS (NACE)

NACE RP0169 (1992) Control of External Corrosion on Underground or Submerged Metallic Piping Systems

ILLUMINATING ENGINEERING SOCIETY (IES)

(2000) Illuminating Engineering Society Handbook

DEPARTMENT OF DEFENSE (DOD)

MIL HDBK 1008C (1997) Fire Protection for Design and Construction

INSTALLATION INFORMATION INFRASTRUCTURE ARCHITECTURE (I3A)

I3A Installation Information Infrastructure Implementation Guide, Ver. 2

AMERICANS WITH DISABILITIES ACT (ADA)

ADA Americans with Disabilities Act--Accessibility Guidelines

UNITED STATES ARMY CORPS OF ENGINEERS (USACE)

Lighting Standards

(1997) Corps of Engineers Standard Lighting Fixture Details  
 Drawing Series No. 40-06-04, <http://cadlib.wes.army.mil>, CADD Details  
 Library, Electrical Details, USACE Standard Details 40-06-04

Electrical Distribution  
 Standards

Corps of Engineers Standard Electrical Distribution Details.  
<http://cadlib.wes.army.mil>, CADD Details Library, Electrical Details,  
 Electrical Service and Distribution

UNITED STATES ARMY TECHNICAL MANUAL (TM)

TM 5-811-1 Electrical Power Supply and Distribution

TM 5-683 Facilities Engineering Electrical Interior Facilities

UFC-3-520-01 Electrical Design, Interior Electrical System

TI-800-01 Technical Instructions- Design Criteria

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)  
 STANDARDS

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA),

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)  
 CODES

UNDERWRITERS LABORATORIES SPECIFICATIONS

1.1 Standard Products

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. The label or listing of the Underwriters Laboratories, Inc., will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted.

1.2 Seismic Protection

Seismic Protection for electrical equipment shall be designed and installed in accordance with the requirements of Seismic Protection for Electrical Equipment Specification SECTION 16070.

1.3 COORDINATION OF ELECTRICAL CRITERIA

All electrical criteria provided in this section shall be coordinated with the architectural section, mechanical section, fire protection section, structural section, interior design section, civil and site section, and

other sections as required. The number and location of all electrical equipment indicated in the electrical requirements & space data sheets are approximate. Contractors design shall meet the intent of the electrical requirements provided in this section. Contractor shall coordinate the final locations of all electrical equipment with the user.

#### 1.4 EXTERIOR PRIMARY ELECTRICAL DISTRIBUTION SYSTEM

General: It shall be the Contractor's responsibility to protect all existing utility lines from damage during excavation. Any damage resulting to existing utility lines and systems shall be repaired by the Contractor, to the satisfaction of the Contracting Officer, at no additional cost to the Government, except as noted below. The Contractor shall be required to locate and mark underground utilities for McConnell AFB owned gas, water, sanitary sewer, storm sewer, and electrical, but excluding fiber/telephone and communications. The Contractor will have use of McConnell AFB utility drawings to aid in their location. The Contractor shall be responsible for the location of the electric lines and all other utilities listed above that are of metal or have tracer wires available for locating. The utilities that are of nonconductive construction such as plastic or Transite and have no tracer wire or other means of applying a signal are to be located from the utility maps to the best of the Contractor's ability. The utilities that are located from maps that appear to be in the vicinity of the excavation are to be hand-dug for location purposes. If a line is damaged that is within 10 feet of that shown on the utility maps, the Contractor will be held responsible for its repair.

##### 1.4.1 Refueler Maintenance.

Run medium voltage (MV) underground conductors from existing pedestal through the manhole (MH) (on which the pedestal sits) to refueler Maintenance pad mounted transformer (existing pedestal is located east of the Topeka, Independence Roads intersection).

##### 1.4.2 Service station.

Run MV underground conductors from refueler Maintenance pad mounted transformer (loop feed) to service station pad mounted transformer routing through the pedestal MH (same pedestal that is located east of Topeka, Independence Roads intersection).

##### 1.4.3 POL

Run MV underground conductors from existing pedestal to the new pad mounted transformer feeding POL (existing pedestal is located east of the Atchison, Independence Roads intersection).

##### 1.4.4 System design.

The distribution level voltage is 12.47 kV. Pedestal switch shall be manufactured by: Durham Co. Labannon, Missouri or approved equal. Coordinate utility interruptions in advance with Contracting Officer. System shall be a radial/loop- MV (primary) system as described above. Primary feeder cables shall be copper and encased in 75 mm of concrete. MV conductors shall have protective shielding. Cable shall be buried below frost line but a minimum of 3 ft below the finished grade to the top of the concrete encasement with continuous cable marker tape and tracer wire 6 inches below grade. Cable markers shall be installed along the length of direct burial cable runs to identify their routes from the surface. Markers will be provided at changes of direction and at intervals not to exceed 500 ft. Electrical on-site distribution system shall be designed in compliance with the rules and recommendations of ANSI C2, National Electrical Safety Code, TM 5-811-1 Electrical Power Supply & Distribution and NFPA 70,

National Electrical Code and UFCGS section 17375 Electrical Distribution system Underground whichever is more stringent. The distribution system and transformers shall be located in near vicinity of the building served. Provide tracer wire and warning tape over all electrical underground utilities. One spare conduit shall be included in the primary ductbank identical in size to the other conduits. Provide pull string in empty conduits. Underground street crossing shall be bored.

1.4.5 Conductors. Provide three 15-kV primary conductors and one 600V insulated neutral. All primary conductor insulation shall be 133 percent and cross-linked polyethylene (NEMA WC7) or ethylene propylene rubber (NEMA WC8). Loading at connections shall be balanced between all three phases. Distribution of primary feeders shall be radial fed as described above. Distribution system includes duct banks, conductors, pad-mounted switches (pedestals) transformers and pads. Coordinate the installation of the electrical system with the telephone and cable TV system companies.

1.4.6 Underground splices. Underground connection or splices are prohibited, except in manholes (MH). Splices shall be in a self-draining, rodent resistant box with a cover.

1.4.7 Transformers. Transformers shall be Contractor furnished and installed. Transformers shall be pad-mounted and have two non-fused switches for the loop connection. The high voltage compartment of the transformer shall include a load break switch with fused circuit for the transformer. The primary voltage shall be 12.47KV, three-phase. The transformed secondary voltages shall be 120/208V, three-phase, four-wire. In selecting a transformer, the name plate rating shall not be less than 90 percent of the kilovolt/amperes (kVA) demand load calculated for the transformer. The demand load shall be calculated per NFPA 70, National Electrical Code. Transformers shall be low profile, pad mounted type, mineral oil insulated, with tamperproof enclosure. Transformers shall be certified non-PCB and shall contain less than 50 parts per million PCB. Transformer shall meet the requirements of this section and specification section 16375

## 1.5 EXTERIOR UNDERGROUND SECONDARY ELECTRICAL DISTRIBUTION REQUIREMENTS

Service laterals shall be underground. The length of secondary distribution service laterals from the transformer secondary to the building service entrances shall be minimized. Secondary service laterals shall be copper conductors in ducts direct-buried. Exterior secondary electrical distribution system to the Refueler Maintenance, Service station & POL shall be 120/208 volt, 3-phase, 4-wire feeder to a Main Distribution Panel (MDP) located in the electrical room. Each facility shall have a MDP. Service entrance equipment (MDP) shall be UL labeled for the application and sized for the available fault current. Main facility feeder and main distribution panel shall be sized to have a minimum of 25% spare capacity above the estimated maximum demand for the building. Design of the exterior secondary electrical system shall be in accordance with Electrical Distribution System, Underground - SECTION 16375 and the requirements of this section. The transformer shall be located a min. of 10 meters from the building served. Sizing of secondary feeders and conduit from the transformer to the facility main distribution panel will be the Contractors responsibility. Service entrance conductors, branch and feeder circuits shall be single conductor Type USE in accordance with NFPA 70. All conductors shall be copper with insulated grounding conductor in conduit. Aluminum conductors and direct buried cables shall NOT be used. One spare conduit shall be included in the secondary ductbank identical in size to

#### the other conduits.1.5.1 Electrical Outlets for Truck Heaters

Provide 10 outlets in weather proof housing pedestal mounted with adequate protection from being knocked by a truck in the Refueler Maintenance parking stalls. Each outlet shall consist of two simplex twist lock receptacle (120V, 20A, 2P, 3W). Each simplex receptacle shall be home run dedicated circuit to the refueler maintenance panelboard in underground conduit. Each pedestal to be located such to serve two stalls.

#### 1.5.2 Entry Gate Power Requirement

Provide 120V, 20A ckt (2- #10, 1-#12 GND in 3/4" C.) from POL panelboard out to the location of entry gate. Provide a NEMA 3R junction box mounted on a pedestal in the vicinity of the gate and provide 18" of pigtail

#### 1.5.3 Conduits

Conduits shall be single, round-bore type, with wall thickness and fittings suitable for the application.

### 1.6 EXTERIOR LIGHTING SYSTEM

Area lighting shall be provided for all parking lots, walkways, above all exit doors, and area signage. Lighting fixtures shall utilize high pressure sodium lamps. Pole/fixture heights shall be no greater than 9.15 meters above finished grade. Fixture/pole finish shall be round tapered brushed aluminum. The light poles should be designed to allow for 160 kilometers per hour wind speed. Design shall be in accordance with IES Handbook, Corps of Engineers Lighting Std. Det. Dwg. No. 40-06-04, Exterior Lighting Specification SECTION 16528, Electrical Distribution System, Underground Specification SECTION 16375 and the requirements in this section.

#### 1.6.1 Area Lighting

Area lighting shall be provided for all areas noted above. Lux levels for the parking lot of Refueler Maintenance & POL lighting shall be 6 lux minimum as measured on the pavement.

##### 1.6.1.1 Walkway Lighting

Walkway lighting fixtures shall be bollards in front of the buildings. Walkway lighting bollards shall be placed along main walkway in front of the facilities and sidewalks leading from each parking lot to the building. Illumination level for new bollards shall be 6 lux along sidewalk. Walkway lighting shall be controlled as described below in lighting control.

##### 1.6.1.2 Parking Lot Lighting

Parking lot lighting fixtures shall be cobra head type fixtures (Corp of Engineers Fixture Type EH2) with single arm or double arms as required mounted on a 9.15 meter tapered brushed aluminum pole. Lamps shall be high pressure sodium and sized to meet lighting criteria (Corp of Engineers Fixture Type EH2). Poles shall not be located within the parking lot areas.

All lighting will be from the perimeter of the parking lot. Control for the parking lot lights will be as described below in lighting control.

### 1.6.1.3 Exterior Building Lighting

Exterior building lighting fixtures shall be Corps of Engineers Fixture Type EH5. Lamps shall be high pressure sodium and sized to provide 10 lux 3 meters from the building. Fixture(s) shall be mounted at each entrance to the building. Exterior building lighting fixtures shall be controlled as described below in lighting control.

### 1.6.1.4 Service Station Lightingg

Provide two light fixture (100w MH each) pole mounted (20'AL round tapered) located in the dipensing fuel island. Locate light switch by the service entrance equipment.

### 1.6.1.4.# Service Station Canopy Lighting (Option)

Provide 4- light fixtures, Corps of Engineers Std Drwg 40-06-04 type PH7. Secure fixtures to structure equally spaced w/ swivel mounts @16' AFF to the bottom of fixture. Run underground branch circuit 20A, 277V from the panelboard (located in the MCC). Locate on/off switch 42" AFF on one of the coloumn.

### 1.6.2 Lighting Control

Provide disconnect switch with HAND-OFF-AUTOMATIC switch and lighting contactors for exterior lighting controls. Install lighting controls in the electrical room of each building. Lighting shall be controlled by a combination of a photocell and astronomical timer when switched to the auto mode. Install lighting controls per requirements of this section. Exact location of all lighting controls shall be verified with the USER during design of the project for each building.

### 1.6.3 Underground Lighting Circuits

Provide underground branch circuits for all exterior lighting circuits. Branch circuits shall be insulated copper conductors with insulated grounding conductor in conduit. Aluminum conductors are NOT acceptable. Direct buried conductors are NOT acceptable. All underground lighting conductors shall be in minimum 27mm Schedule 40 PVC conduit. Top of conduit shall be 900mm below finished grade.

#### 1.6.3.1 Lighting Pole Grounding

All exterior lighting poles or bollards shall be grounded at the base of the pole. Provide a 19 mm by 3050.0 mm copper clad grounding rod at each pole.

#### 1.6.3.2 Conductors

Cables shall be type USE conforming to UL 854, with copper conductors and type RHW or XHHW insulation conforming to UL 44, and shall include green ground conductor. Cable shall be provided with insulation of a thickness not less than that given in TABLE 15.1 of UL 854. Cable shall be rated for 600 volts. Parts of the cable system such as splices and terminations shall be rated not less than 600 volts. Conductors larger than No. 8 AWG shall be stranded.

### 1.6.3.3 Conduits

Conduits shall be single, round-bore type, with wall thickness and fittings suitable for the application. Conduits shall be direct-burial, schedule 40 for lighting circuits.

### 1.6.4 Building Lighting Circuits

All exterior fixtures mounted on the surface of the building shall be wired from within the building and shall conform to the Interior Wiring Methods paragraph of this section. No building lighting circuits shall be surface mounted.

### 1.6.5 Hazardous locations

Areas that are classified hazardous are indicated. Electrical wiring and devices, fixtures installed in such locations shall as a minimum meet the NFPA requirements.

## 1.7 EXTERIOR COMMUNICATION DISTRIBUTION SYSTEM

### 1.7.1 Communications Overview

This design shall be in accordance with the Telephone System, Outside Plant Specification SECTION 16711, Fiber Optic Outside Plant Specification SECTION 16713 and the requirements of this section. McConnell AFB personnel will locate underground Post telephone and communications lines. The contractor shall deliver a diagram showing the approximate area that the posts telephone and communication lines need to be located. The Contractor shall mark the proposed route or limits of the excavation in white prior to the request where to mark for utilities. The Contractor should allow a minimum of ten (10) working days for the utility locates to be conducted. If the Contractor damages any marked lines during excavation, the Contractor shall contact the Government QA Representative immediately to determine whether the Contractor will perform repairs or reimburse the Government for repairs. Both telephone and single mode fiber optic cable will be required for the Refueler, service station & POL facilities.

### 1.7.2 Refueler Maintenance

Install 2-4" underground duct bank direct buried from MH 19 to the facility comm. Room and stub adjacent to the telephone terminal board (TTB). Install 4 -1" inner ducts in 1- 4" duct. Run 1 - 12 strand Single mode (SM) fiber optic cable (FOC) in 1- 1" inner duct from MH 19 to comm. Room. Terminate FOC on patch panel provided in the comm. Room. Provide 50 ft of FOC in MH 19 for base comm. Personnel to splice the FOC. Run 1- 25 pair 24 AWG copper cable in 1-1" inner duct from MH 19 to comm. Room. Terminate on 110 block provided on TTB. Provide 15 ft of copper cable in MH 20 for base comm. personnel to splice.

### 1.7.3 Service station

Service station comm requirements shall be extended from POL. Sketch #1 attached to this section identifies two empty 1 1/2" conduits from the service station island to the control room of POL. Cabling to service station through these empty conduits shall be by others.

### 1.7.4 POLL

Install 2-4" underground duct bank direct buried from MH 19 to the facility comm. Room and stub adjacent to the telephone terminal board (TTB). Install 4 -1" inner ducts in 1- 4" duct. Run 1 - 12 strand Single mode (SM) fiber optic cable (FOC) in 1- 1" inner duct from MH 19 to comm. Room. Terminate FOC on patch panel provided in the comm. Room. Provide 50 ft of FOC in MH 19 for base comm. Personnel to splice the FOC. Run 1- 75 pair 24 AWG copper cable in 1-4" duct from MH 19 to comm. Room. Terminate on 110 blocks provided on TTB. Provide 15 ft of copper cable in MH 19 for base comm. personnel to splice.

#### 1.8 CATHODIC PROTECTION SYSTEM

A sacrificial anode cathodic protection system shall be provided for all underground metallic lines, fittings, valves and fire hydrants. In addition to the anodes, all metallic pipes must be provided with a coating system. The systems shall be designed and installed in accordance with NACE RP 169 Standards. Criteria for determining the adequacy of protection shall be in accordance with NACE RP-01-69 and shall be selected by the corrosion engineer as applicable. Design shall be in accordance with Cathodic Protection System, (Sacrificial Anode) - Specification SECTION 13110 and the requirements of this section. Each anode shall be connected to the structure through a flush-to-grade test station with a concrete maintenance collar. At least one test station shall be provided on each valve, fire hydrant and metallic pipe.

#### 1.9 UNDERGROUND CABLE MARKINGS

All underground cables and ductbank should be marked with utility marking tape with appropriate utility type label name.

#### 1.10 INTERIOR ELECTRICAL DISTRIBUTION SYSTEM

The interior secondary distribution voltage within the building shall be 208/120 volt, 3-phase, 4-wire. Conductors shall be copper. Aluminum conductors shall not be used. The voltage (208 volts 3 phase) shall be used for larger motor loads, equipment loads and all other required loads. The lower voltage (120 volts 1 phase) shall be used for all lighting loads, receptacle, small motors, computer, and all other loads as required. Design shall be in accordance with Electrical Work, Interior - Specification SECTION 16415 and the requirements of this section.

##### 1.10.1 Service Equipment Main Distribution Panel (MDP)

Service equipment/disconnecting means shall be provided in the Main Distribution Panel (MDP) located in the electrical room of each building except service station service equipment shall be located exterior adjacent to the pad mounted transformer. The MDP shall be a free standing switchboard if service is determined to be 800 amps or greater or a wall mounted panelboard if less than 800 amps. Service disconnect means shall be of the bolt-on circuit breaker type. MDP shall include transient voltage surge protection incorporated into the panel. Metering shall include kwh meter, voltage meter, current meter, and shall be equipped with pulse initiators for connection to the base EMCS. The main breaker shall be solid state and the branch breakers shall be molded case. All breakers 225 amps and larger shall be adjustable trip.

##### 1.10.2 Protective Coordination Study

A protective coordination study to include overcurrent and short circuit analysis shall be done on the electrical distribution system for the building if the building service transformer is 750 kva or larger. The study shall include the interior electrical distribution system back to the secondary side of the pad mounted transformer.

#### 1.10.3 Panelboards

Lighting and appliance branch-circuit panelboards shall be of the bolt-on molded case circuit breaker type conforming to NEMA AB-1 and UL 489 and shall be located in the electrical room. Enclosures shall be general purpose wall mounted type. Busses for all panelboards shall be copper. Aluminium shall not be used. The maximum number of poles in an individual panelboard shall be 42 poles.

- a. All panelboards shall have after construction, a minimum of 25 percent spare capacity for all loads. Panelboards shall have a minimum of 25 percent spare circuit breakers. Spare circuit breakers shall be redundant of the type of circuit breaker being provided in the panelboard.

#### 1.10.4 Emergency Power requirements.

POL.

Provide an emergency diesel generator sized for the entire building load with auto transfer switch (ATS). Locate generator in mechanical yard. Above ground fuel tank to hold a min of 400 gallons shall be located in close proximity to the generator. ATS shall be housed in the electrical closet.

Service station.

Provide a weather proof emergency receptacle with a manual transfer switch for mobile generator hook up. Install receptacle & transfer on a free standing structure in close proximity of the serving MCC.

#### 1.10.5 Motors

Motors shall be of sufficient size for the duty to be performed and shall not exceed the full-loading rating when the driven equipment is operating at specified capacity under the most severe conditions encountered.

- a. All motors shall have open frames and continuous-duty classification and be based on a 40-degree C ambient temperature reference.
- b. All permanently wired polyphase motors of 747 watts or more shall meet the minimum full-load efficiencies as indicated in Section 16415: ELECTRICAL WORK, INTERIOR.
- c. Motors with power supplied from a variable frequency drive shall be a definite purpose inverter fed motor in accordance with Part 31 NEMA MG-1.

#### 1.10.6 General Purpose Receptacles

Duplex receptacles for general purpose applications shall be NEMA 5-20R, 20 amp, 125 volt, 2-pole, 3-wire grounding type. A maximum of five duplex

receptacles may be connected to a receptacle circuit. Receptacle circuits shall not supply lighting loads and shall have dedicated neutrals. All receptacle circuits shall be 20 amps. General purpose duplex receptacles shall be located in the facility per the space data sheets and limited as described below:

- a. Provide general duplex receptacles every 3.5 meters along the walls in all areas of the building. For small rooms that do not have 3.5 meter walls, a minimum of one (1) outlet shall be installed on each wall. All office receptacle circuits shall be calculated for one computer. The computer load used for circuits shall be 600 VA. General receptacle loads shall be calculated in accordance with the National Electrical Code. Receptacles shall be mounted 380mm above finished floor.
- b. Provide a general purpose duplex receptacle adjacent to sink in each bathroom. Receptacles shall have (GFI) ground fault interrupters.

#### 1.10.7 Special Receptacles

Ground Fault Interrupter (GFI) receptacles shall be provided at all sink countertops, janitor's closet, wet locations or any other location required by the National Electrical Code. Weatherproof receptacles for exterior use, shall be mounted in a box with a gasketed, weatherproof, cast-metal cover plate and gasketed cap over each receptacle opening with (GFI). Exact location of the receptacles noted below shall be coordinated with the user during the design of this project. Provide NEMA 5-20R 20 amp, 125 volt, 2-pole, 3-wire grounding type, duplex receptacles. Each receptacle shall be on a dedicated circuit and as described in the space data sheets but not limited to the following locations and as indicated elsewhere in this proposal.

- a. Provide duplex receptacles for microwave, coffee maker and full size refrigerator in the staff room. All appliances shall provided and installed by the government.
- b. Provide a duplex receptacle for each electric water cooler.
- c. Provide duplex receptacles for the government furnished and government installed copier and fax machine.
- d. Provide a duplex receptacle with ground fault interrupter on the exterior of the building adjacent to each exit door of the building. Mount receptacles 610mm above finished grade.
- e. Provide two (2) 20 A, quad outlets, each on a dedicated circuit in the DOIM COMM. Room. One should be mounted on the plywood backboard and the other mounted on LAN Rack.
- f. Provide duplex outlets for laboratory counter-top equally spaced 600mm on center for the entire length of the counters in the laboratory.
- g. Provide one (1) dedicated NEMA 5--20R, 20 amp, 125 volt duplex receptacle for EMCS and DCC panels.
- h. Provide one clock outlet as indicated in space data sheets. Clock outlets shall be single, 15 amp, 125 volt, 2-pole, 3-wire grounding type receptacles. Outlets shall be mounted 2135mm AFF. All locations should be coordinated with the user.

- i. Provide duplex receptacles for computers as indicated in the space data sheets. A maximum of three duplex computer outlets shall be connected to a circuit. Circuits shall be sized using 600 volt-amp per computer. Separate neutral conductors shall be provided with each circuit. Outlets shall be mounted adjacent to the Telephone/Data outlets. Maintain a separation of 160mm from the Telephone/Data outlets. Exact location of all Computer Outlets shall be verified and coordinated with the user during the design of the project.
- j. Provide 5-20R-20A, 125V receptacle in ceiling of classroom
- k. Provide 5-20R-20A, 125V receptacle for projection screen & switch with center off controls.

#### 1.10.8 Other Loads

Contractor shall provide electrical power to the following loads either by receptacle or direct wired as applicable:

- a. Closed Circuit Television (CCTV): Provide 4 -20 amp duplex receptacles, each on a dedicated circuit. Two shall be for CCTV backboard and one for a CCTV equipment cabinet. This equipment will be located in the comm room.
- b. Intercom: Contractor shall provide power as required for Contractor provided installed intercom system.
- d. Kitchen Equipment: Contractor shall provide power receptacles and connections as required for kitchen equipment in break room. A list of equipment is described in the space data sheet. Any equipment with a load requirement greater than 750 VA shall be on a dedicated circuit.

#### 1.10.9 Architectural/Mechanical Connections

Contractor shall provide branch circuits, disconnect switches, magnetic starters, and all other related electrical equipment and material for all architectural, mechanical equipment and environmental equipment to be installed in the project (includes the facility and site). This shall include all HVAC units, unit heaters, pumps, exhaust fans, irrigation control panel and all other mechanical equipment in the facility. Disconnect switches shall be provided for all equipment that is not within site of the panel disconnecting means. All three phase motors shall have phase failure protectors. Designated sinks and toilets shall be controlled by passive infrared sensors hard wired to the building electrical distribution system. No batteries shall be allowed for this purpose. Contractor shall coordinate these electrical requirements with the architectural and mechanical requirements.

#### 1.11 INTERIOR LIGHTING SYSTEM

The interior design shall be in accordance with the requirements in this section, the IES Handbook, the "Electrical Work, Interior" Specification - SECTION 16415, space data sheets and the requirements in this section. Light fixture selection and color shall be coordinated with the Architect and Interior Designer. All fixtures provided for this facility shall meet the requirements listed in the light fixture details. The details can be downloaded from the web site listed under Lighting Standards in the References section.

#### 1.11.1 Task Lightingg

Fluorescent task lighting shall be provided as indicated on space data sheets. Fixtures shall meet the requirements for Corp Fixture Type FF1.

#### 1.11.2 Conservation Requirements

Illumination levels, in conjunction with energy conservation, shall be obtained by the most life cycle cost-effective techniques including, but not limited to, the following:

- a. Provide occupancy sensors as considered appropriate for the application and as coordinated with user during design of project. Occupancy sensor shall meet the requirements listed in the light fixture details. The details can be downloaded from the web site listed as Lighting Standards under the References heading.
- b. Provide energy efficient lamps and solid-state electronic ballasts.

#### 1.11.3 Fluorescent Fixtures

Fluorescent light fixtures with T8, 32 watt lamps shall be used in most areas of the building. All fixtures with open reflectors shall be of the self locking type or have a shield installed to prevent fluorescent light tubes from falling out. All ballasts shall be of the energy saving electronic type with power factor exceeding 90%. Lamps shall be broad spectrum and provide a warm color. Lamps shall be high efficiency with a minimum of 90 lumens per watt (32W lamp), have a color rendition index of 75 and have a color temperature of 3500K.

#### 1.11.4 Incandescent or Lighting Fixtures

Incandescent lighting fixtures shall NOT be used.

#### 1.11.5 Compact Fluorescent lighting fixtureess

Compact fluorescent lighting fixtures shall be electronic ballast type.

#### 1.11.6 Egress and Exit Lighting Fixtures

Egress and exit lighting design shall be in accordance with NFPA 101. Exit lights shall be green LED type XL1 - Corps of Engineers Lighting Standard. Det. Dwg. No. 40-06-04. Exit lighting shall flash upon initiation of the fire alarm system. Egress lighting power shall be provided from room fluorescent light fixtures unswitched leg with an emergency battery and lamp supply unit installed. Typical through out the facilities.

#### 1.11.7 Wire Guards

Provide wire guards for all open type light fixtures.

### 1.12 INTERIOR COMMUNICATION SYSTEM

#### 1.12.1 General

The Contractor shall prewire the building for a voice/data for Category 5e

compliant. All telephone/data outlets shall be provided with duplex 8-position jacks (RJ45), one telephone and one data. Cable used shall be EIA/TIA Category 5e, UTP solid copper station wire. Wire shall be routed in a minimum 27mm conduit installed in the walls to the cable tray. Conduit should include a nylon pull string for adding additional cables in the future. Wire basket type tray shall be provided to route cables back to the Communications Room. Cable tray should also be used for routing CCTV and Intercom System cables. Cables for different systems shall be physically separated by barriers. All communications circuits shall be continuous and free of splices from communications room to outlet. Cable tray shall be sized in accordance with I3A standards. Conduit shall be used to bridge cable trays through fire rated walls. Ladder type cable racks shall be installed in Communications Room to route cables from cable tray to the communications rack and telephone backboard. Connect all telephone outlets to Type 110 cross connects mounted on telephone terminal backboard in the Communications Room. Data jacks shall be mounted to Category 5e Patch panels mounted in a free standing rack located in the Communications Room. Communications room layout shall conform to Figure 2-2 of I3A standard. All electronic devices (computers, file servers, hubs, concentrators, phones, etc.) are not part of this contract and will be installed by the user. Each facility design shall be in accordance with the Premises Distribution System Specification - SECTION 16710, Electrical Work, Interior Specification SECTION 16415, space data sheets and the requirements of this section. Testing shall be done in accordance with TSB-67, EIA/TIA-568A as required in Premise Distribution System Specification Section 16710 with all test results provided to the COR.

#### 1.12.2 Telephone Terminal Backboard

Provide a 19 mm plywood backboard on one long wall and the back wall of the Communications Room. Provide surge arrestors and 110 type cross connect blocks for the incoming telephone conductors. The plywood telephone backboards shall be provided with a fire retardant coating. Contractor shall coordinate location of incoming telephone service with the location of the surge arrestors and cross connect blocks on the telephone backboard.

See Special Receptacle section for power requirements. All underground conduits entering the Communication Room shall be stubbed up 150 mm above finished floor adjacent to the telephone backboard. All stubbed conduits shall be sealed with polyurethane foam duct seal.

#### 1.12.3 Telephone Conductors/Conduits

Copper cables shall be 24 gauge, 4 pair, EIA-TIA-568A Category-5e, unshielded twisted pair (UTP) solid copper station cable. Terminate cables on jacks with EIA 568A standard for wiring. All telephone/data conductors shall be installed in 27mm conduits with bushings per Wiring Methods paragraph in this section.

#### 1.12.4 Telephone/Data/LAN Outlets

Telephone/data/LAN outlets shall consist of one telephone jack and one data jack. Telephone and data outlets shall be installed in the same junction box. Telephone jacks shall be used for voice communication and data jacks shall be used for data communication. Each outlet shall be mounted 380mm above finished floor. All jacks shall be terminated using the T 568B standard. Provide telephone/data outlets at each of the locations indicated in the following paragraphs:

#### 1.12.5 Telephone/Data Outlets

The location of outlets shall be as indicated on the space data sheets. Add outlets in office spaces of POL & Refueler maintenance over and above shown in the space data sheets for maximum spacing between the outlets to not exceed 6ft.

#### 1.12.6 Telephone Single Outlets

Location of single telephone outlet shall be as indicated on the space data sheets. Telephone single jacks shall be ivory in color. Outlets shall be mounted at 1220mm above finished floor. Wall plates shall be suitable for mounting standard wall phones.

#### 1.12.7 LAN Rack

Contractor shall provide a free-standing rack in the Communication Room. See special receptacle paragraph for power requirements.

#### 1.13 CROSS CONNECT CABLES

Provide 25 pair #24 AWG telephone cables with 50 pin connectors at each patch panel and punch down the other end of the cable at the cross-connect blocks. Support all telephone cables by cable racks installed in the Communications Room.

#### 1.14 RJ45 PATCH PANELS

Provide RJ 45 patch panels for all data circuits in the project. Patch panels shall include 20% spare for future expansion.

#### 1.15 FIBER-OPTIC PATCH PANELS

Incoming fiber-optic cables shall be terminated in rack mounted patch panel suitable for ST type connectors.

#### 1.16 COMMUNICATION GROUNDING

All exposed non-current carrying metallic parts of the telephone equipment, cable sheaths, cable splices and terminals shall be grounded. Contractor shall provide a Master Ground Bus (MGB) in the Communication Room per Premises Distribution System - Specification Section 16710.

#### 1.17 INTERCOM SYSTEM

In POL (with extension to service station), provide an intercom system which allows for individual room/area communication. The intent of such a system is for two way communication rather than general announcements or music. Locate system master panel at the control room with a slave panel, location of which as determined later during the design. Both the master and slave panels shall have the capability of zone selective or system wide distribution of announcements. System remotes shall be located as determined during design. Remotes shall be mounted at 1375mm above finished floor or grade and each shall be hands free operation.

#### 1.18 INTRUSION DETECTION SYSTEM

No requirement for IDS has been identified for the buildings.

## 1.19 CLOSED CIRCUIT TELEVISION SYSTEM

### 1.19.1 CCTV Camera Locations

Provide a complete CCTV raceway system. Contractor shall provide conduit, cable tray, j-boxes, wireways and outlet boxes as required to support the user furnished and installed CCTV system. On site there is one existing camera which will remain. Extend cable from the existing camera to the POL bldg in underground conduit. Communications cable tray can be used inside the building for this system. Portion of cable tray used for CCTV shall be separated by a barrier. Camera shall will require a RG-59 and a 18/2 NTP cable or match existing. The minimum conduit size shall be 27mm.

### 1.19.2 Monitor Locations

Provide two connectors in control room. see space data sheet for more info. Exact location of monitor boxes shall be coordinated with the user during design. Coax from connectors shall be run in conduit.

### 1.19.3 CCTV Equipment Requirements

Conduit shall terminate at the power supply backboard located at the comm. room. All conduit ends shall be provided with bushings and labelled to identify rooms and equipment served. The comm room will contain a 610mm(w) x 1220 mm (h) backboard for CCTV power supplies and equipment. In additon space will be requried for a 1220mm (w) x 710mm (d) x 2130mm (h) government provided free standing cabinet. CCTV support equipment locations shall be verified and coordinated during the design of the project.

## 1.20 CABLE TELEVISION

Provide a 21mm conduit w/pullwire, outlet box and cover plate from the Ready room area to the above ceiling mounted cable tray. Coordinate outlet box location with the user. In the Communications Room provide a dedicated wall space, 915mm X 915mm backboard for cable television. Cable and connection will be by Others.

## 1.21 ENERGY MONITORING AND CONTROL SYSTEM (EMCS)

Provide power as required for all EMCS or DDC components (such as dampers, VAV boxes, control panels, etc.) requiring power. The EMCS software and hardware shall be modified to incorporate the building into the system.

## 1.22 WIRING METHODS

Wiring shall conform to NFPA 70, Section 16415: ELECTRICAL WORK, INTERIOR, and the requirements of this section.

### 1.22.1 Power Conductors

Conductors shall be copper only. Aluminum conductors are not allowed. Minimum conductor size shall be #12 A.W.G. Conductors shall be installed in conduits. Power and lighting conductors shall be 600 volt, Type THHN (in dry locations), and THW or THWN (in wet locations).

### 1.22.2 Communication Conductors

Communication conductors shall be provided per paragraph Telephone Conductors of this section and Premises Distribution System, Specification Section 16710.

#### 1.22.3 Conduits

Wiring shall consist of insulated conductors installed in rigid zinc-coated steel conduit, electrical metallic tubing, electrical intermediate metal conduit or rigid nonmetallic conduit. Plastic conduit, when used, shall be in accordance with Article 347 of the NEC. Raceways shall be concealed within finished walls, ceilings, and floors.

#### 1.23 GROUNDING SYSTEM

The grounding system shall be designed in accordance with NEC Article 250 and the following criteria. In general, all metallic building components including reinforcing steel and miscellaneous metals shall be part of an electrically continuous ground system. Steel studs used in interior wall construction, T bars of the ceiling grid, diffusers of the air distribution system, and door hardware are exempt from this bonding requirement. Bonding shall be by exothermic welding or the brazing of a copper wire between components. Design shall be in accordance with Electrical Work, Interior Specification - SECTION 16415 and this section.

##### 1.23.1 Communication Grounding System

Grounding for the main telephone service shall be provided by installing an insulated #6 copper grounding conductor in 27mm conduit from the Master Grounding Bus (located in the Communication Room) to the building service ground.

##### 1.23.2 Grounding Conductors

A green equipment grounding conductor, sized in accordance with NFPA 70 shall be provided, regardless of the type of conduit. Equipment grounding bars shall be provided in all panelboards. The equipment grounding conductors shall be carried back to the service entrance grounding connection or separately derived grounding connection. Grounding conductors shall be provided in all branch (including lighting circuits) and feeder circuits.

#### 1.24 FIRE DETECTION AND ALARM SYSTEM

Design shall be in accordance with Section 13851: FIRE DETECTION AND ALARM, ADDRESSABLE, and the requirements of Section 01022: FIRE PROTECTION REQUIREMENTS.

#### 1.25 TESTING

Contractor shall provide all testing required by all specifications listed in Division 16. No testing requirements can be deleted from the master specifications.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

SECTION 01018  
Space Data Sheets

-- End of Section --

## **Space Data Sheet**

DACA41-03-R-0008-0001

Corrosion Control Facilities  
McConnell Air Force Base  
Building: **Refueler Maintenance Facility**

**Room Name:** Work Bays (3 ea.) (Entire bay area from floor (including pits/depressions) to roof structure and wall to wall is classified as Class 1 Division 1)

**Room Number:** 100

**Adjacencies/Area Allocation:** Required adjacencies and minimum room size are indicated on the Government approved plan included in the set of drawings.

**Occupancy:** (3)

**Function:**

- Refueler vehicle maintenance and repair

**Power/Data/Communications Requirements:**

- (8) reel-type 120V drop cords with twist lock connectors
- (4) RJ-45S combination phone/data outlets, each under (1) cover plate.
- (6) NEMA 5-20R GFCI duplex receptacles
- Grounding points: Inside each work bay located adjacent to the roll up door and outside each work bay in vehicle parking located adjacent to the roll up door.

**Environmental Requirements:**

- Negative room pressure relative to adjacent spaces
- Provide means to mechanically ventilate (purge) entire work bay area per NEC
- Provide air exhaust fans and louvers as required
- All electrical & mechanical equipment must be explosion proof, classification class1, Division 1
- Ambient Room Temperature: Year round ventilation, 55 degrees F (winter) +/- 1 degree F
- Relative Humidity: N/A
- Minimum Lighting: 50 FC @ 36" A.F.F.
- Light Source: HID & Industrial fluorescent strip
- Exhaust extractor system; hoses capable of reaching a refueler vehicle's exhaust pipe
- Ventilated trench drains in locations indicated on the plans
- Ventilated floor recess for hydraulic lift
- Oil and water separator with alarm
- Waste oil collection point w/storage tank
- Egress and emergency lighting required

**Plumbing requirements:**

- Safety station w/eye wash and emergency shower (2 ea.)
- (1) electric water cooler
- (8) Compressed air drops
- Utility sink (pedestal type) and high rise faucet w/spray attachment

**FF&E:**

- Interior Finishes: Reference the Room Finish Schedule on Government drawing sheet B\_IN601 and applicable Government outline and/or fully edited technical specifications for the required finishes.

**Remarks:**

- Class I, Division I type construction
- Insulated garage doors w/glazed panels and electric openers
- Recessed (flush w/floor) 75,000 lb hydraulic lift & crane rail rated at 2 ton capacity
- Surface mounted FEC

## **Space Data Sheet**

DACA41-03-R-0008-0001

Corrosion Control Facilities  
McConnell Air Force Base  
Building: **Refueler Maintenance Facility**

**Room Name:** Mechanical/Electrical Room

**Room Number:** 101

**Adjacencies/Area Allocation:** Required adjacencies and minimum room size are indicated on the Government approved plan included in the set of drawings.

**Occupancy:** N/A

**Function:**

- Provide space for mechanical and electrical equipment

**Power/Data/Communications Requirements:**

- (2) NEMA 5-20R duplex receptacles at 48" A.F.F.
- (1) RJ-11 wall mounted at 48" A.F.F.
- Electrical service entrance

**Environmental Requirements:**

- Ambient Room Temperature: Year round ventilation, 55 degrees F (winter) +/- 1 degree F
- Minimum Lighting: 50 FC @ 36" A.F.F.
- Light Source: Industrial fluorescent strip
- Emergency lighting required

**Plumbing requirements:**

- Floor drain
- Hose bib
- Domestic water service entrance
- Fire riser location
- Compressed air equipment

**FF&E:**

- Interior Finishes: Reference the Room Finish Schedule on Government drawing sheet B\_IN601 and applicable Government outline and/or fully edited technical specifications for the required finishes.

**Remarks:**

- Size and configuration to be modified as necessary based on mechanical/electrical equipment selected
- Exterior doors (pair)

## **Space Data Sheet**

DACA41-03-R-0008-0001

Corrosion Control Facilities  
McConnell Air Force Base  
Building: **Refueler Maintenance Facility**

**Room Name:** Communications Room

**Room Number:** 102

**Adjacencies/Area Allocation:** Required adjacencies and minimum room size are indicated on the Government approved plan included in the set of drawings.

**Occupancy:** N/A

**Functions:**

- Provides space for communications equipment

**Power/Data/Communications Requirements:**

- (2) 120 VAC 60 Hz quadraplex receptacles @ 54" A.F.F.
- Isolated ground for backboard
- (2) RJ-45S combination phone/data outlets under (1) coverplate
- Fire alarm control panel and radio transceiver

**Environmental Requirements:**

- Ambient Room Temperature: 75 degrees F (summer) +/- 1 degree F, 72 degrees F (winter) +/- 1 degree F
- Relative Humidity: 50% relative humidity in cooling mode
- Minimum Lighting: 50 FC @ 36" A.F.F.
- Light Source: Industrial fluorescent strip

**Plumbing requirements:**

- None

**FF&E:**

- Interior Finishes: Reference the Room Finish Schedule on Government drawing sheet B\_IN601 and applicable Government outline and/or fully edited technical specifications for the required finishes.

**Remarks:**

- Exterior door
- Terminal board, 4' x 8' x 3/4" A/C plywood, shellacked

## **Space Data Sheet**

DACA41-03-R-0008-0001

Corrosion Control Facilities  
McConnell Air Force Base  
Building: **Refueler Maintenance Facility**

**Room Name:** Tool Room

**Room Number:** 103

**Adjacencies/Area Allocation:** Required adjacencies and minimum room size are indicated on the Government approved plan included in the set of drawings.

**Occupancy:** N/A

**Functions:**

- Provides space for communications equipment

**Power/Data/Communications Requirements:**

- No additional requirements beyond those contained in the NEC.

**Environmental Requirements:**

- Ambient Room Temperature: Year round ventilation, 55 degrees F (winter) +/- 1 degree F
- Minimum Lighting: 20 FC @ 36" A.F.F.
- Light Source: Industrial fluorescent strip

**Plumbing requirements:**

- One (1) compressed air drop

**FF&E:**

- Interior Finishes: Reference the Room Finish Schedule on Government drawing sheet B\_IN601 and applicable Government outline and/or fully edited technical specifications for the required finishes.

**Remarks:**

- Pair of doors to work bay area

## **Space Data Sheet**

DACA41-03-R-0008-0001

Corrosion Control Facilities  
McConnell Air Force Base  
Building: **Refueler Maintenance Facility**

**Room Name:** Inspection Bay Equipment

**Room Number:** 104

**Adjacencies/Area Allocation:** Required adjacencies and minimum room size are indicated on the Government approved plan included in the set of drawings.

**Occupancy:** N/A

**Functions:**

- Provides space for communications equipment

**Power/Data/Communications Requirements:**

- No additional requirements beyond those contained in the NEC.

**Environmental Requirements:**

- Ambient Room Temperature: Year round ventilation, 55 degrees F (winter) +/- 1 degree F
- Minimum Lighting: 20 FC @ 36" A.F.F.
- Light Source: Industrial fluorescent strip

**Plumbing requirements:**

- Vehicle wash bay system including pump, transformer, timer, regulator, valves, chemical tank w/auto mixer, pressure regulator, hose boom and high pressure hose, trigger wand and holder, etc.
- Floor drain
- One hose bibb
- One (1) Compressed air drop

**FF&E:**

- Interior Finishes: Reference the Room Finish Schedule on Government drawing sheet B\_IN601 and applicable Government outline and/or fully edited technical specifications for the required finishes.

**Remarks:**

- Door to wash bay area
- Size and configuration to be modified as necessary based on mechanical/electrical equipment selected
- CMU Wall separating the tool room and wash bay equipment room and the door to the wash bay will be eliminated if the optional wash bay is not funded, i.e. the tool room would be expanded to include the wash room equipment space

## **Space Data Sheet**

DACA41-03-R-0008-0001

Corrosion Control Facilities  
McConnell Air Force Base  
Building: **Refueler Maintenance Facility**

**Room Name:** Clean Room (Men's)

**Room Number:** 105

**Adjacencies/Area Allocation:** Required adjacencies and minimum room size are indicated on the Government approved plan included in the set of drawings.

**Occupancy:** N/A

**Functions:**

- Shower and lockers for employees

**Power/Data/Communications Requirements:**

- No additional requirements beyond those contained in the NEC

**Environmental Requirements:**

- Ambient Room Temperature: 75 degrees F (summer) +/- 1 degree F, 72 degrees F (winter) +/- 1 degree F
- Relative Humidity: 50% relative humidity in cooling mode
- Minimum Lighting: 20 FC @ 36" A.F.F.
- Light Source: Fluorescent troffer
- Provide air intake louvers as required
- Provide air exhaust fans and louvers as required

**Plumbing requirements:**

- (1) Shower
- floor drain

**FF&E:**

- Interior Finishes: Reference the Room Finish Schedule on Government drawing sheet B\_IN601 and applicable Government outline and/or fully edited technical specifications for the required finishes.
- Provide 6" high seamless resinous coved wall base integral with flooring.
- Provide metal double tier lockers in quantities and in locations as shown on the Government drawings and edited technical specification section 10500, LOCKERS
- Construct and install a wall-mounted shower bench in locations and to dimensions in accordance with the Government drawings.
- Provide and install solid polymer shower wall panels and soap dish in accordance with the Government drawings and outline specification Section 06000, DIVISION 6: WOOD AND PLASTICS (paragraph Section 06650, SOLID POLYMER FABRICATIONS)
- Provide shower/toilet accessories in locations and quantities as shown on the Government drawings and outline specification Section 10000, DIVISION 10: SPECIALTIES (paragraph 1.8, SECTION 10800A, TOILET ACCESSORIES).

**Remarks:**

- None

## **Space Data Sheet**

DACA41-03-R-0008-0001

Corrosion Control Facilities  
McConnell Air Force Base  
Building: **Refueler Maintenance Facility**

**Room Name:** Men's Restroom

**Room Number:** 106

**Adjacencies/Area Allocation:** Required adjacencies and minimum room size are indicated on the Government approved plan included in the set of drawings.

**Occupancy:** N/A

**Functions:**

- Restroom facilities for employees and visitors

**Power/Data/Communications Requirements:**

- (1) NEMA 5-20R GFCI duplex receptacles above lavatory counter

**Environmental Requirements:**

- Ambient Room Temperature: 75 degrees F (summer) +/- 1 degree F, 72 degrees F (winter) +/- 1 degree F
- Relative Humidity: 50% relative humidity in cooling mode
- Minimum Lighting: 20 FC @ 36" A.F.F.
- Light Source: Fluorescent troffer
- Provide air intake louvers as required
- Provide air exhaust fans and louvers as required

**Plumbing requirements:**

- (1) Wall mounted toilet
- (1) Lavatory with high rise faucet

**FF&E:**

- Interior Finishes: Reference the Room Finish Schedule on Government drawing sheet B\_IN601 and applicable Government outline and/or fully edited technical specifications for the required finishes.
- Provide 6" high seamless resinous coved wall base integral with flooring.
- Provide shower/toilet accessories in locations and quantities as shown on the Government drawings and outline specification Section 10000, DIVISION 10: SPECIALTIES (paragraph 1.8, SECTION 10800A, TOILET ACCESSORIES). Meet all ADA requirements for mounting heights, dimensions, and clearances where applicable.
- Construct vanity and solid polymer material vanity top in accordance with Government drawings and outline specification Section 06000, DIVISION 6: WOOD & PLASTICS (paragraph 1.5, SECTION 06650, SOLID POLYMER FABRICATIONS).
- Provide solid phenolic toilet partitions in accordance with Government drawings and outline specification Section 10000, DIVISION 10: SPECIALTIES (paragraph 1.8, SECTION 10160A, TOILET PARTITIONS). Meet all ADA requirements for mounting heights, dimensions, and clearances where applicable.

**Remarks:**

- Door access from Corridor 107

## **Space Data Sheet**

DACA41-03-R-0008-0001

Corrosion Control Facilities  
McConnell Air Force Base  
Building: **Refueler Maintenance Facility**

**Room Name:** Vestibule (Men's Restroom)

**Room Number:** 107

**Adjacencies/Area Allocation:** Required adjacencies and minimum room size are indicated on the Government approved plan included in the set of drawings.

**Occupancy:** N/A

**Functions:**

- Eliminates direct sightlines into restroom/clean room facilities

**Power/Data/Communications Requirements:**

- No additional requirements beyond those contained in the NEC

**Environmental Requirements:**

- Ambient Room Temperature: 75 degrees F (summer) +/- 1 degree F, 72 degrees F (winter) +/- 1 degree F
- Relative Humidity: 50% relative humidity in cooling mode
- Minimum Lighting: 20 FC @ 36" A.F.F.
- Light Source: Fluorescent troffer
- Provide air intake louvers as required
- Provide air exhaust fans and louvers as required

**Plumbing requirements:**

- None

**FF&E:**

- Interior Finishes: Reference the Room Finish Schedule on Government drawing sheet B\_IN601 and applicable Government outline and/or fully edited technical specifications for the required finishes.

**Remarks:**

- None

## **Space Data Sheet**

DACA41-03-R-0008-0001

Corrosion Control Facilities  
McConnell Air Force Base  
Building: **Refueler Maintenance Facility**

**Room Name:** Clean Room (Women's)

**Room Number:** 108

**Adjacencies/Area Allocation:** Required adjacencies and minimum room size are indicated on the Government approved plan included in the set of drawings.

**Occupancy:** N/A

**Functions:**

- Showers and lockers for employees

**Power/Data/Communications Requirements:**

- No additional requirements beyond those contained in the NEC

**Environmental Requirements:**

- Ambient Room Temperature: 75 degrees F (summer) +/- 1 degree F, 72 degrees F (winter) +/- 1 degree F
- Relative Humidity: 50% relative humidity in cooling mode
- Minimum Lighting: 20 FC @ 36" A.F.F.
- Light Source: Fluorescent troffer
- Provide air intake louvers as required
- Provide air exhaust fans and louvers as required

**Plumbing requirements:**

- (1) Shower
- floor drain

**FF&E:**

- Interior Finishes: Reference the Room Finish Schedule on Government drawing sheet B\_IN601 and applicable Government outline and/or fully edited technical specifications for the required finishes.
- Provide 6" high seamless resinous coved wall base integral with flooring.
- Provide metal double tier lockers in quantities and in locations as shown on the Government drawings and edited technical specification section 10500, LOCKERS
- Construct and install a wall-mounted shower bench in locations and to dimensions in accordance with the Government drawings.
- Provide and install solid polymer shower wall panels and soap dish in accordance with the Government drawings and outline specification Section 06000, DIVISION 6: WOOD AND PLASTICS (paragraph Section 06650, SOLID POLYMER FABRICATIONS)
- Provide shower/toilet accessories in locations and quantities as shown on the Government drawings and outline specification Section 10000, DIVISION 10: SPECIALTIES (paragraph 1.8, SECTION 10800A, TOILET ACCESSORIES).

**Remarks:**

- None

## **Space Data Sheet**

DACA41-03-R-0008-0001

Corrosion Control Facilities  
McConnell Air Force Base  
Building: **Refueler Maintenance Facility**

**Room Name:** Women's Restroom

**Room Number:** 109

**Adjacencies/Area Allocation:** Required adjacencies and minimum room size are indicated on the Government approved plan included in the set of drawings.

**Occupancy:** N/A

### **Functions:**

- Restroom facilities for employees and visitors

### **Power/Data/Communications Requirements:**

- Minimum requirements per NEC
- (1) NEMA 5-20R GFCI duplex receptacles above lavatory counter

### **Environmental Requirements:**

- Ambient Room Temperature: 75 degrees F (summer) +/- 1 degree F, 72 degrees F (winter) +/- 1 degree F
- Relative Humidity: 50% relative humidity in cooling mode
- Minimum Lighting: 20 FC @ 36" A.F.F.
- Light Source: Fluorescent troffer
- Provide air intake louvers as required
- Provide air exhaust fans and louvers as required

### **FF&E:**

- Interior Finishes: Reference the Room Finish Schedule on Government drawing sheet B\_IN601 and applicable Government outline and/or fully edited technical specifications for the required finishes.
- Provide 6" high seamless resinous coved wall base integral with flooring.
- Provide shower/toilet accessories in locations and quantities as shown on the Government drawings and outline specification Section 10000, DIVISION 10: SPECIALTIES (paragraph 1.8, SECTION 10800A, TOILET ACCESSORIES). Meet all ADA requirements for mounting heights, dimensions, and clearances where applicable.
- Construct vanity and solid polymer material vanity top in accordance with Government drawings and outline specification Section 06000, DIVISION 6: WOOD & PLASTICS (paragraph 1.5, SECTION 06650, SOLID POLYMER FABRICATIONS).
- Provide solid phenolic toilet partitions in accordance with Government drawings and outline specification Section 10000, DIVISION 10: SPECIALTIES (paragraph 1.8, SECTION 10160A, TOILET PARTITIONS). Meet all ADA requirements for mounting heights, dimensions, and clearances where applicable.

### **Plumbing requirements:**

- (1) Wall mounted toilet
- (1) Lavatory with high rise faucet

### **Remarks:**

- Door access from Corridor 107

## **Space Data Sheet**

DACA41-03-R-0008-0001

Corrosion Control Facilities  
McConnell Air Force Base  
Building: **Refueler Maintenance Facility**

**Room Name:** Vestibule (Women's Restroom)

**Room Number:** 110

**Adjacencies/Area Allocation:** Required adjacencies and minimum room size are indicated on the Government approved plan included in the set of drawings.

**Occupancy:** N/A

**Functions:**

- Eliminates direct sightlines into restroom/clean room facilities

**Power/Data/Communications Requirements:**

- No additional requirements beyond those contained in the NEC

**Environmental Requirements:**

- Ambient Room Temperature: 75 degrees F (summer) +/- 1 degree F, 72 degrees F (winter) +/- 1 degree F
- Relative Humidity: 50% relative humidity in cooling mode
- Minimum Lighting: 20 FC @ 36" A.F.F.
- Light Source: Fluorescent troffer
- Provide air intake louvers as required
- Provide air exhaust fans and louvers as required

**Plumbing requirements:**

- None

**FF&E:**

- Interior Finishes: Reference the Room Finish Schedule on Government drawing sheet B\_IN601 and applicable Government outline and/or fully edited technical specifications for the required finishes.

**Remarks:**

- None

## **Space Data Sheet**

DACA41-03-R-0008-0001

Corrosion Control Facilities  
McConnell Air Force Base  
Building: **Refueler Maintenance Facility**

**Room Name:** Corridor

**Room Number:** 111

**Adjacencies/Area Allocation:** Required adjacencies and minimum room size are indicated on the Government approved plan included in the set of drawings.

**Occupancy:** N/A

**Functions:**

- Internal circulation

**Power/Data/Communications Requirements:**

- No additional requirements beyond those contained in the NEC

**Environmental Requirements:**

- Ambient Room Temperature: 75 degrees F (summer) +/- 1 degree F, 72 degrees F (winter) +/- 1 degree F
- Relative Humidity: 50% relative humidity in cooling mode
- Minimum Lighting: 20 FC @ 36" A.F.F.
- Light Source: Fluorescent troffer

**Plumbing requirements:**

- None

**FF&E:**

- Interior Finishes: Reference the Room Finish Schedule on Government drawing sheet B\_IN601 and applicable Government outline and/or fully edited technical specifications for the required finishes.

**Remarks:**

- Interior access to restroom/lockers, offices, work bays and wash bay

## **Space Data Sheet**

DACA41-03-R-0008-0001

Corrosion Control Facilities  
McConnell Air Force Base  
Building: **Refueler Maintenance Facility**

**Room Name:** Office

**Room Number:** 112

**Adjacencies/Area Allocation:** Required adjacencies and minimum room size are indicated on the Government approved plan included in the set of drawings.

**Occupancy:** (4)

**Functions:**

- Administrative support for refueler maintenance operations
- Break area

**Power/Data/Communications Requirements:**

- (1) NEMA 5-20R duplex receptacle per wall
- (1) Combination phone/data outlets per wall, each combination outlet under (1) coverplate.
- (1) duplex receptacle at 84" A.F.F. for wall clock

**Environmental Requirements:**

- Ambient Room Temperature: 75 degrees F (summer) +/- 1 degree F, 72 degrees F (winter) +/- 1 degree F
- Relative Humidity: 50% relative humidity in cooling mode
- Minimum Lighting: 50 FC @ 36" A.F.F.
- Light Source: Fluorescent troffer

**Plumbing requirements:**

- None

**FF&E:**

- Interior Finishes: Reference the Room Finish Schedule on Government drawing sheet B\_IN601 and applicable Government outline and/or fully edited technical specifications for the required finishes.
- ~~Provide panel based systems furniture configuration for one person to include a corner computer station, overhead flipper door storage, task lighting, undercounter mobile pedestal and lateral file. Systems furniture configuration and performance requirements shall be in accordance with the Government drawings and fully edited technical specification SECTION 12705, FURNITURE SYSTEMS.~~
- Wood framed dry erase markerboard 4' wide by 3' high.
- Room will accommodate one full size refrigerator (N.I.C.)

**Remarks:**

- Door access from Corridor 107
- Visual access to outdoors and work bays

## **Space Data Sheet**

DACA41-03-R-0008-0001

Corrosion Control Facilities  
McConnell Air Force Base  
Building: **Refueler Maintenance Facility**

**Room Name:** Vestibule

**Room Number:** 113

**Adjacencies/Area Allocation:** Required adjacencies and minimum room size are indicated on the Government approved plan included in the set of drawings.

**Occupancy:** N/A

**Functions:**

- Air lock for Corridor 107

**Power/Data/Communications Requirements:**

- Minimum requirements per NEC

**Environmental Requirements:**

- Ambient Room Temperature: 75 degrees F (summer) +/- 1 degree F, 72 degrees F (winter) +/- 1 degree F
- Relative Humidity: 50% relative humidity in cooling mode
- Minimum Lighting: 15 FC @ 36" A.F.F.
- Light Source: Fluorescent troffer
- Emergency and exit lighting required

**Plumbing requirements:**

- None

**FF&E:**

- Interior Finishes: Reference the Room Finish Schedule on Government drawing sheet B\_IN601 and applicable Government outline and/or fully edited technical specifications for the required finishes.
- A surface mounted entrance mat shall be provided. Floor mat shall extend wall-to wall and door-to-door to include custom fit cutouts as necessary to achieve full floor coverage. Floor mat shall be a ball-and-socket, roll-up, type. Floor mat system shall include an acrylic-vinyl square profile perimeter frame. Reference government edited specification Section 12690, ENTRANCE MAT.
- 

**Remarks:**

- Door access from Corridor 107
- Visual access to outdoors
- Fire alarm annunciator panel located to allow direct sightline from building exterior
- Provide half-saddle thresholds at both vestibule doors to accommodate and transition floor mat.

## Space Data Sheet

DACA41-03-R-0008-0001

Corrosion Control Facilities  
McConnell Air Force Base  
Building: **Refueler Maintenance Facility**

**Room Name:** Office

**Room Number:** 114

**Adjacencies/Area Allocation:** Required adjacencies and minimum room size are indicated on the Government approved plan included in the set of drawings.

**Occupancy:** (4)

**Functions:**

- Administrative support for vehicle washing and inspection operations
- Break Area

**Power/Data/Communications Requirements:**

- (1) NEMA 5-20R duplex receptacle per wall
- (1) Combination phone/data outlets per wall, each combination outlet under (1) coverplate.
- (1) duplex receptacle at 84" A.F.F. for wall clock

**Environmental Requirements:**

- Ambient Room Temperature: 75 degrees F (summer) +/- 1 degree F, 72 degrees F (winter) +/- 1 degree F
- Relative Humidity: 50% relative humidity in cooling mode
- Minimum Lighting: 50 FC @ 36" A.F.F.
- Light Source: Fluorescent troffer

**Plumbing requirements:**

- None

**FF&E:**

- Interior Finishes: Reference the Room Finish Schedule on Government drawing sheet B\_IN601 and applicable Government outline and/or fully edited technical specifications for the required finishes.
- ~~Provide panel based systems furniture configuration for one person to include a corner computer station, overhead flipper door storage, task lighting, undercounter mobile pedestal and lateral file. Systems furniture configuration and performance requirements shall be in accordance with the Government drawings and fully edited technical specification SECTION 12705, FURNITURE SYSTEMS.~~
- Wood framed dry erase markerboard 4' wide by 3' high.
- Room shall accommodate one full size refrigerator.

**Remarks:**

- Door access from Corridor 107
- Visual access to outdoors and wash bay

## **Space Data Sheet**

DACA41-03-R-0008-0001

Corrosion Control Facilities  
McConnell Air Force Base  
Building: **Refueler Maintenance Facility**

**Room Name:** Inspection Bay. (Entire bay area from floor (including pits/depressions) to roof structure and wall to wall is classified as Class 1 Division 1)

**Room Number:** 115

**Adjacencies/Area Allocation:** Required adjacencies and minimum room size are indicated on the Government approved plan included in the set of drawings.

**Occupancy:** (1-2)

**Function:**

- Refueler vehicle inspection

**Power/Data/Communications Requirements:**

- All equipment rated for wet or damp locations

**Environmental Requirements:**

- Provide means to mechanically ventilate (purge) entire inspection bay area
- Provide air exhaust fans and louvers as required
- All electrical & mechanical equipment must be explosion proof
- Ambient Room Temperature: Year round ventilation, 55 degrees F (winter) +/- 1 degree F
- Relative Humidity: N/A
- Minimum Lighting: 50 FC @ 36" A.F.F.
- Light Source: Industrial fluorescent strip rated for wet or damp locations
- Exhaust extractor system; hoses capable of reaching a refueler vehicle's exhaust pipe
- Ventilated trench drains in locations indicated on the plans
- Oil and water separator with alarm (annunciates in both offices)
- Egress and emergency lighting required

**Plumbing requirements:**

- (1) electric water cooler
- Wash equipment
- (1) compressed air drop

**FF&E:**

- Interior Finishes: Reference the Room Finish Schedule on Government drawing sheet B\_IN601 and applicable Government outline and/or fully edited technical specifications for the required finishes

**Remarks:**

- Class I, Division I type construction
- Insulated garage doors w/glazed panels and electric openers

## SECTION 01020

## 60 PERCENT DESIGN REQUIREMENTS

## PART 1 60 PERCENT DESIGN SUBMITTALS

Attachments: Code Analysis  
ADA Architectural Design Checklist

For general submittal requirements, See Section 01331 SUBMITTALS FOR DESIGN.

## 1.1 SITE PLANNING

## 1.1.1 Drawings

## 1.1.1.1 Location Plan and Vicinity Map

The Location Plan and Vicinity Map provided in the Request For Proposal (RFP) shall be updated as necessary and included in the drawings. The Location Plan shall include the Contractor's Access Route, Staging Area, and the Project Site.

1.1.1.2 **Construction Phasing**

**The construction phasing plan will show how the Contractor will maintain access to the site (6:00 A.M. to 6:00 P.M. Monday thru Friday) for the duration of the contract. At all times access to parking for AF personnel & equipment shall be provided. Phasing plan shall include any signage, temporary access drives, or temporary parking needed.**

## 1.1.1.3 Removal Plan

The removal plan will show the existing physical features and condition of the site before construction. Each physical feature to be removed shall be hatched as indicated on the standard legend sheet, a legend on the removal plan, and properly noted: to be removed, to remain, or to be relocated. The Removal Plan shall be prepared at the same drawing scale and use the sheet boundaries as the Site Plan.

## 1.1.1.4 Site Plan

The Site Plan shall show all the site layout information necessary to field locate the building, parking lots, roads, sidewalks, and all other appurtenances to be constructed as part of the project. All major site work to be constructed will be dimensioned for size and location. The Site Plan will identify all site-related items such as: curbs, pavements, walks, bollards, trash enclosures, chiller units, electrical transformers locations, etc. in accordance with a standard legend sheet or with additional legends or notes. Drawing scales of between one inch to 20 feet, 30 feet, or 40 feet (for plans with sparse information) are acceptable scales for the Site Plan.

The contractor shall consider the project's construction area, drawing legibility, number of sheets required in choosing the drawing scale. The Site Plan, prior to adding the dimensions and notes, should serve as the base sheet to other Plans, such as: Utilities Plan, Grading and Drainage Plans and Landscape Plan. Existing and proposed contours or utility lines shall not be shown on Site Plan. Physical features that will remain after the proposed construction has been completed shall be shown. This plan, or the Location Plan, will also show any free zones, construction limits, etc. Whenever the Site Plan occupies more than one sheet of drawings, a Key Plan shall be included. Additional plans showing specific areas of the site in smaller scales can be included if more detail is necessary.

#### 1.1.1.5 Site Details

The Contractor shall provide designs and details as necessary for site furnishings, accessories, accessible parkings stalls and ramps, bollards, signage, striping, and any other site structure or item requiring a detail for clarity and construction accuracy.

#### 1.1.1.6 Landscape Plans

A detailed Landscape Plan showing trees, shrubs, ground covers, seeded and sodded areas, shall be prepared by the Contractor.

#### 1.1.1 Specifications

Provide marked up of all Technical Specifications proposed for use in the final site design. Line through deletions and enbolden additions.

#### 1.1.2 Design Analysis Narrative

Design analysis shall include the following:

##### 1.1.3.1 Design References

Design references used in preparing the site design.

##### 1.1.3.2 Basis, Specific Goals, Objectives and Priorities For Site Design

The Design Analysis should give the basis, specific goals, objectives and priorities for site design of the project. Identify, explain and document use of design criteria and how the design meets goals, objectives and priorities. Identify the preferred site development concept. Document pollution prevention measures and other environmental considerations made during design. The 60 percent Design Analysis must be approved and accepted before Final Design.

##### 1.1.2.1 Sustainable Design Objectives

The Design Analysis shall include the proposed sustainable design objectives with reference to site planning and civil design work which will be attained as part of this project. The SpiRiT will be completed and included.

## 1.2 CIVIL

***In addition to the following requirements the 60% submittal shall include incorporation of all comments from earlier design submittals and conferences.***

#### 1.2.1 Drawings

##### 1.2.1.1 Grading and Drainage Plan

A preliminary grading and drainage plan showing the proposed layout of all new culverts and roof drains shall be provided at the same scale as the site plan. Existing grading contours shall be indicated at 1 foot contour intervals. New grading contours shall be shown. Indicate finished floor elevation of new buildings. Plans shall show the layout of the new and existing storm drain and roof drain system. Also include layout of subdrains. Storm drain system shall be labeled. The rim elevations of all manholes, curb inlets, and area inlets shall be indicated. Label sizes and materials.

##### 1.2.1.2 Typical Pavement Sections

Provide typical pavement and road sections and details showing interface between new and existing pavements and new pavements of different sections.

#### 1.2.2 Specifications

Provide a listing by title and number of all Technical Specifications proposed for use in the final civil design.

#### 1.2.3 Design Analysis Narrative

Design analysis shall include the following:

##### 1.2.3.1 References

Design references used in preparing the civil design.

##### 1.2.3.2 Grading

A narrative of the grading design and criteria used.

##### 1.2.3.3 Pavements

A narrative of the pavement design and criteria used plus design calculations used to obtain the pavement design. Include copies of programs and manuals used to develop the pavement design sections.

##### 1.2.3.4 Drainage

A narrative of the drainage design and criteria used. Include information on the culvert pipe materials anticipated to be used.

##### 1.2.3.5 Basis, Specific Goals, Objectives and Priorities For Civil Design

The Design Analysis should give the basis for the civil design and should establish specific goals, objectives and priorities for civil design of the project. Identify, explain and document use of design criteria and how the design meets goals, objectives and priorities. Identify the preferred site development concept. Document pollution prevention measures and other

environmental considerations made during design. The 60 percent Design Analysis must be accepted before Final Design.

### 1.3 GEOTECHNICAL

See Civil and Structural Design Requirements.

### 1.4 WATER SUPPLY AND WASTEWATER

#### 1.4.1 Drawings

##### 1.4.1.1 Water Distribution and Sewage Collection Systems Plan (including building services)

Provide all existing utilities and above ground features which may pose as an obstacle (i.e., water, sewer, gas, electrical, etc.) on the utility plan that references in the site plan. Exclude siting notes and dimensions from the plan. Provide all proposed new water and sewer lines with preliminary sizes. This shall include all new service lines up to the 5 foot building line. Show the proposed locations of all new manholes, fire hydrants, valves (including PIV's), and connection points.

##### 1.4.1.2 Water Distribution and Sewage Collection Systems Profiles

Profiles of all gravity sewers and waterlines shall be provided. Profiles may be omitted for short waterlines, unless necessary to assure adequate cover or avoid interference with other underground facilities. Indicate existing pipe material and sizes where new lines connect. Indicate type of connection and elevation. Include all interference elevations of crossing utilities and structures.

##### 1.4.1.3 Water Distribution and Sewage Collection Systems Details

Appropriate water and sewer details shall be provided. The standard detail sheets will be furnished if required. For roadway pavement crossings, indicate installation method (boring, jacking, trenchless excavation, etc.). Include standard casing details.

#### 1.4.2 Specifications

Specifications shall be coordinated with the plans and include all items. Provide a listing of specifications to be provided. Provide a complete copy of special sections to cover those subjects for which no UFGS guide specifications are used or available. Deletions from the guide specs should be indicated by striking through and additions by bold or underscore.

#### 1.4.3 Design Analysis Narrative

Design analysis shall include the following:

##### 1.4.3.1 References

Provide design references used in preparing the water and wastewater design.

##### 1.4.3.2 Water Supply and Distribution Systems

A narrative of the water supply and distribution systems design and applicable criteria used shall be provided. Include the peak and average domestic demands, the fire flow required and the available flow and

residual pressures. A description of the water distribution system, a listing of allowable piping materials, hydrant flow test data and preliminary calculations necessary to support equipment, piping sizes, fire and domestic demands, etc., shall be provided.

#### 1.4.3.3 Wastewater and Sewers

Based on existing information the sanitary sewer system in the vicinity of the proposed facility is assumed to be adequate to carry the flows expected to be generated by the new facility. A narrative of the wastewater supply design and applicable criteria used shall be provided. Include the preliminary calculations used to design the average and peak contributing flows. Field verify the available capacity and full flow capacity of the existing system to ensure that it will be adequate for the flows generated by the new facility. Include the available capacity and full flow capacity in the design analysis. Preliminary calculations necessary to support equipment and piping sizes and a listing of allowable piping materials shall be provided.

### 1.5 Exterior Gas Distribution System

#### 1.5.1 Design Narrative

The 60 Percent Design Analysis Narrative shall include the information presented in the 35 percent submittal. The information shall be corrected to reflect changes in content made in response to review comments, and shall be expanded to reflect the 60 percent design.

#### 1.5.2 Pipe Sizing Calculations

The 60 percent calculations shall include all the information presented in the 35 percent submittal, shall be corrected to reflect changes in content made in response to review comments, and shall be expanded to reflect the 60 percent design. In addition, new calculations shall be as specified in Section 01019, 35 PERCENT DESIGN REQUIREMENTS and the narrative sections (01012 and 01016) referenced there.

#### 1.5.3 Exterior Utility Drawings

The 60 percent drawings shall include all the information presented in the 35 percent submittal, shall be corrected to reflect changes in content made in response to review comments, and shall be expanded to reflect the 60 percent design. In addition, any new drawings shall be as specified in Section 01019, 35 PERCENT DESIGN REQUIREMENTS.

#### 1.5.4 SPECIFICATIONS

The submitted 35 percent technical guide specifications shall be updated, completely edited, and fully coordinated with the drawings to accurately and clearly identify the 60 percent product and installation requirements for the facility. Technical specifications shall be Unified Facilities Guide Specifications (UFGS), which shall be completely edited and fully coordinated with the drawings to accurately and clearly identify the product and installation requirements for the facility as specified in Section 02000, DIVISION 2: SITE WORK - OUTLINE SPECIFICATIONS. In addition, new specifications shall be as specified in Section 01019, 35 PERCENT DESIGN REQUIREMENTS and the narrative sections (01012 and 01016) referenced there. Deletions from the guide specs should be indicated by striking through and additions by bold or underscore.

#### 1.5.4.1 Items to be Fast Tracked

All items to be fast tracked shall be as specified in Section 01019, 35 PERCENT DESIGN REQUIREMENTS.

### 1.6 ARCHITECTURAL

#### 1.6.1 Drawings

The Sixty percent architectural drawing submittal shall be a complete set of architectural drawings without large scale details. All other drawings shall be complete except referencing of the large scale details.

##### 1.6.1.1 Floor Plans

Provide a double line Floor Plan, drawn at the largest scale practicable to include the entire building on a single sheet. See paragraph on Drawing Scales for plan scale requirements. Floor plans shall essentially be complete with the exception of large scale detail referencing. Floor plans shall be scaled double-line drawings showing the functional arrangement, pocheing, location of all openings and plumbing fixtures, all section cuts, wall types, all notes and leaders, all general notes, and all dimensions shall be completed. The plans shall indicate door swings, door numbers and window type; door and window schedules are required. A north arrow shall be shown on each floor plan. Enlarged toilet and stair plans shall also be included. The first composite plan sheet shall include a gross area tabulation comparing the actual square meters with the authorized square meters of the facility. Architect-Engineer suggestions for plan improvement shall be fully shown and justified. Include the following:

- Overall, control, and door/ window opening dimensioning.
- Match lines for combining individual portions of floor plans.
- Room names and numbers.
- Structural column or bay indicators.
- Wall and building section cuts.
- Door swings and door numbers.
- Window types.
- Area in square meters.
- General notes.
- All Floor & Wall Patterns/Borders.

When dimensioning, use arrowheads, not dots or slashes. Where major structural elements are included as parts of architectural detailing, do not indicate sizes. These elements should all be fully defined as part of the structural design documents. Major elements of mechanical and electrical equipment affecting room size or shape, shall be shown on the architectural plans to a practicable extent and coordinated with other respective disciplines. When applicable, Government-furnished, Contractor-installed, or Government-furnished and Government-installed items shall be shown as a dashed line.

##### 1.6.1.2 Reflected Ceiling Plans

Reflected ceiling plans shall be complete including all electrical lights, mechanical supply & diffusers, notes, complete legends and pocheing of all materials to be used. See paragraph on Drawing Scales for reflected ceiling plan scale requirements.

#### 1.6.1.3 Roof Plan

Roof plans shall be complete including all notes, legends, slope indications, gutter and downspout locations, and roof overflow drains. All elements located on the roof shall be coordinated with all disciplines. See paragraph on Drawing Scales for roof plan scale requirements. Roof mounted equipment should be limited to exhaust fans, vents, and intakes, no large pieces of equipment shall be allowed to be mounted on the roof.

#### 1.6.1.4 Building Elevations

Provide all building elevations complete showing the appearance and architectural treatment. Elevations shall be dimensioned to show total height, and relation to grade. Critical elevations such as top of finish floor, top of steel, etc. shall be indicated. All notes for materials shall be included. See paragraph on Drawing Scales for Exterior Building Elevation scale requirements.

#### 1.6.1.5 Building Sections

Building cross section and longitudinal sections shall be included to show general interior volumes, construction methods, and height of ceilings and partitions. Identify materials used and necessary dimensions. See paragraph on Drawing Scales for Building Section scale requirements.

#### 1.6.1.6 Wall Sections

Drawings shall include all wall sections and stair section conditions including corridors, showing vertical control elevations and dimensions, with all materials labeled. The sections should normally be cut through doors, windows, and other critical wall section locations. Wall sections shall not be broken. Additional details shall be included when necessary to illustrate important or unusual features. All horizontal dimensions shall occur on the plans and vertical dimensions on the sections and elevations. See paragraph on Drawing Scales for Wall Section scale requirements.

#### 1.6.1.7 Door, Window, and Louver Schedules

Door schedule shall be complete in accordance with Corps of Engineers (COE) standard format. Schedule shall include door and frame types, except referencing to door details and hardware sets. Window and louver schedules shall be complete including window and louver types except referencing to details.

#### 1.6.1.8 Fire Ratings

Wall ratings, and fire hazards shall be clearly indicated as required by Fire Protection criteria. Wall fire ratings shall be graphically shown by a continuous symbol or pocheing within the wall on a Fire Protection /Life Safety Plan. When other functions coexist with the fire protection functions, their integration shall be clearly indicated, with an analysis that describes how both functions will be served. Provide a separate, floor plan which makes an accurate presentation of these various features and functions.

#### 1.6.1.9 Drawing Scales

Architectural work shall be drawn at the scales listed below. Other scales

may be used only by written authorization through the Technical Manager, Omaha District. Units of measurements shown on the drawings shall be done in millimeters. All disciplines should use the same scale for plan sheets. The following is a comparison guide to establish equivalent scaling of drawings:

	<u>METRIC</u>
Composite Plans (Note 1)	Varies
Floor Plans	1:100
Reflected Ceiling Plans	1:100
Detail Plans (Note 2)	1:20
Roof Plans	1:100
Exterior Elevations	Same scale as plan
Interior Elevations	1:20
Interior Toilet Elevations	1:20
Building Cross Sections	1:100 or 1:50
Wall Sections (Note 3)	1:10
Stair Sections	1:20
Details (Note 2)	1:5
Wall Types	1:10
Fire Protection Plans (Note 1)	Varies

Notes:

1. Scale of composite plan shall be as required so that the entire facility is drawn on one sheet without break lines.
2. The goal of this requirement is that the details be large enough to show all fixtures, accessories, equipment, materials, manner of construction, clearances required for proper maintenance, and complete dimensions. Toilet rooms and Equipment rooms are examples of the kind of spaces which shall be drawn as a Detail Plan.

1.6.1.10 Legends

Standard architectural material symbols used on the drawings shall be provided as a separate architectural legend drawing located just in front of the architectural drawings in the set. Additional material symbols should be added to the Legend Sheet as needed for the project.

1.6.1.11 North Arrows and Graph Scales

North arrows shall be oriented the same direction on all plan sheets and by all disciplines; including site and civil drawings. Plan north shall be "up" or the left on the drawings. Indicate true north on composite plan drawings. North arrows shall be located approximately at the same location on all sheets. Graphic scale shall be placed on each drawing.

1.6.1.12 Modular Design

Modular Design practices shall be followed in the design of all masonry buildings or components of buildings. Dimensions shall be figured to whole or half-unit lengths of standard units in order to reduce on-site cutting of masonry.

1.6.1.13 Symbols

The Room and Door Numbering system shall be consistent. The standard

symbols for Amendments (a triangular box) or Modifications (a type of circular box, see the chapter on Drafting Criteria) to the contract shall not be used for any other purpose, and care must be taken to avoid using even similar appearing but technically different symbols. Room numbering shall start at the main entrance and proceed clockwise around functional areas.

#### 1.6.1.14 Schedules

Schedules for room finish, doors, windows, louvers, etc., shall be clear and complete. As many columns as necessary should be provided in order to present the essential information. The "Remarks" column should not be used as a substitute for an information column. Normally a single item should be presented on each schedule line. Other scheduling methods as standard with the A-E may be used if approved by written authorization from the Project Architect, Omaha District.

#### 1.6.1.15 Notes

Notes may be placed on drawings to reduce the amount of repetitive drafting, provided that clarity is not lost. General notes should be placed at the right-hand edge of the sheet and, if possible, should be located on the first sheet in the set. Notes that pertain to each drawing however, should be placed on each drawing.

#### 1.5.1.18 Dimensions

Dimensions must be complete, accurate and fully coordinated. Dimensions should be to points easily measurable in the construction, and should be laid out to eliminate refiguring in the field. Dimensions should be tied-in to column lines, etc., to facilitate checking. Plan dimensions for frame construction should be to face of stud (or sheathing) for exterior walls, to one face of stud for interior partitions, and to centerline of openings. For masonry construction, dimensions should be to one or both nominal faces of masonry and to jambs of openings.

#### 1.6.1.16 Access to Utilities

All utilities within the building, such as piping, ductwork, electrical work, etc., shall be concealed in finished areas. Provide plumbing chases in toilet areas. The clear space above ceilings and the size of chases must be carefully figured to accommodate piping slopes and connections, ductwork crossovers, and similar situations. Access must be provided to valves, cleanouts, etc. Space provided for utilities systems must be adequate but should not be excessive.

#### 1.6.1.17 Reflected Ceiling Plans

Reflected Ceiling Plans shall be provided for all spaces in the building. Reflected ceiling plans shall show the ceiling tile layout and location of gypsum wallboard and other ceiling types where applicable. All light fixtures, air diffusers, grilles, registers, PA speakers, sprinkler head layout, smoke and heat detectors - if ceiling mounted, and other ceiling mounted items will also be shown on the reflected ceiling plans. The fixtures and other equipment shall be laid out in a regular pattern symmetrical with the ceiling tile grid, or symmetrical with the room centerlines, columns, windows, or other feature that dominates. All ceiling mounted items shown shall be fully coordinated with all other

disciplines.

#### 1.6.1.18 Sketches

All sketches presented during the design phase shall be reduced to 8-1/2" by 11" and included in this design analysis to document the design options and decisions evaluated during the design process.

#### 1.6.2 Technical Specifications

##### 1.6.2.1 Use of Technical Guide Specifications

Technical Unified Federal Guide Specifications (UFGS) shall be used to achieve the maximum uniformity in contract requirements. The technical guide specifications describe the type and quality of material and installation normally acceptable for Corps construction, and often represent specific agreement between the Corps and the applicable industry. The provisions of the technical guide specifications should not be changed without justification. The 60% submittal shall include a draft edited specifications of all the applicable sections. Items added or deleted in these specification sections shall be evident. Complete descriptions including specific size, gauge, and configuration are included in the technical Guide Specifications for a wide variety of items. The designer must be familiar with the technical Guide Specification requirements in order to provide details fully coordinated with the technical specification descriptions. Terminology used on the drawings shall be the same as used in the Technical Guide Specifications. Where it is desirable to detail a variance with the standard provisions of the Technical Guide Specifications, the specifications must be revised to coordinate with the details. In addition to the guidance in specification Section 01332, SUBMITTAL PROCEDURES FOR CONSTRUCTION on editing technical specifications, data and sample submittals for all interior and exterior finishes shall be "G" submittals.

##### a. New Guide Specifications

New guide specifications shall be limited to those specialty type items not covered in the regular sections of Technical Guide Specifications or provided as a requirement listed in the various CSI divisions within this document.

#### 1.6.3 Design Analysis Narrative

The Design Analysis shall be essentially complete with emphasis on the following:

##### 1.6.3.1 Basic Criteria Statement

A statement indicating the basic criteria to be applied to the design including type of construction (noncombustible, etc.), category of construction (permanent, etc.), major fire protection and exit requirements, etc..

##### 1.6.3.2 Description of Materials

A description of materials for all major building components and of all interior and exterior finishes ascertaining their matching of existing. The description of materials must include type of exterior wall construction, room finish schedule, window types, panel materials, etc.

The description of materials should follow the continuity of the Military Handbook 1190. The description of finishes may be presented in schedule form.

#### 1.6.3.3 General Parameters

The design analysis shall follow the format described herein.

- a. The purposes, overall functions, and total capacities of the facility.
- b. The design theme or visual appearance of the exterior and interiors of the building, and how this facility coordinates with the image criteria of the installation on which it will be constructed.
- c. The number of personnel to use facility.
- d. The type of activities and equipment involved.
- e. The anticipated life of the functions to be accommodated.
- f. The category of construction; permanent

#### 1.6.3.4 Functional and Technical Requirements

- a. Functional areas, occupant capacities, and allocation, including a functional relationship matrix.
- b. All items of equipment, required.
- c. Occupational safety and health.
- e. Energy conservation energy budget goals.
- f. Sound and vibration control.
- g. Interior service areas.
- h. Physical security; lock and keying, intrusion-detection, alarms, restricted access areas, interior guard support, and ties to local authorities.
- i. Justification for selection of exterior and interior finishes and materials.
- j. Moisture Vapor Control.
- k. Lessons learned incorporated into the design.

#### 1.6.3.5 Design Objectives and Provisions

- a. Adaptation of the building to the size, shape, and orientation of the site.
- b. Building layout to establish convenient circulation flows during normal operation and emergency evacuation activities, for materials, equipment, services, and people.

- c.** Grouping spaces into sound-compatible zones and protective construction zones, e.g., for fire and storm.
- d.** Space layout compatible with modular (structural and environmental) support systems.
- e.** Type of construction materials, architectural systems, and finishes.
- f.** Building expandability/changeability.
- g.** Physical security.
- i.** Energy conservation. (insulation, orientation)
- j.** Acoustical design.
- k.** Moisture vapor condensation design.
- l.** Composition of masses and spaces architectural compatibility and architectural details to reflect the design theme and desired image, and the scale and nature of the activities involved.
- m.** Perception of the building details and volumes. (Specific provisions made, e.g., an identifiable sequence of viewing positions for experiencing the interior and exterior architectural design.)
- n.** Enhancement of materials and systems maintenance and operation.
- o.** Economy of building construction, operation, and maintenance: life-cycle cost effectiveness.

#### 1.6.3.6 Coordination with Installation or Outside Agencies

- a.** Physical security support.
- b.** Occupational safety and health, as required.
- c.** Government furnished equipment.
- d.** Operations and maintenance support.

#### 1.6.3.7 Checklists

Fire Protection Code Analysis shall be included in the Design Analysis. See Attachments Code Analysis and ADA Architectural Design Checklist at the end of this section.

#### 1.6.4 Design Analysis Calculations

- a.** Net room areas, occupant capacity and gross building areas.

(Categorize areas and capacities under the titles of "Operational Space Requirements", "Administrative Space Requirements", "Storage Space Requirements", and "Support Space Requirements".)

- b.** U-values for each wall, window, door, or roof type studied or selected.

c. Acoustics.

d. Rainfall intensity relative to roof area and roof drain size and number calculations.

e. Sustainable Design. The Design Analysis shall include the proposed sustainable design objectives with reference to building design and construction work which will be attained as part of this project.

## 1.7 INTERIORS

The interior design portion of the submittal shall address both building-related and furniture-related portions of the comprehensive interior design.

### 1.7.1 Design Analysis/Narrative

A section for interior design shall be included in the design analysis. This section shall include:

A. A detailed narrative statement of design objective with an explanation of the desired image or visual appearance of the interior of the facility and the design intent.

B. Description and rationale for finish materials used, their performance characteristics, durability, maintenance requirements, and other pertinent data.

C. Sustainable Design. The Design Analysis shall include the proposed sustainable design objectives with reference to interior finishes and furnishings design which will be attained as part of this project.

### 1.7.2 Technical Specifications

Provide a complete listing of all interior finish, equipment, and furnishings related specification sections which will be provided in this project.

### 1.7.3 Color Boards

Preliminary architectural (AE) design color boards shall be supplied in the format described in government specification Section 09920, CONTRACTOR COLOR BOARDS, paragraphs 2.1 and 3.1. The color boards shall show actual color samples of all proposed exterior and interior building finishes, and, on separate color boards, the proposed coordinating furniture finishes. Samples shall be identified by a universal symbol that is used to describe the material on the color boards and drawings for cross reference purposes.

A copy of the Interior Finish Schedule and Interior Finish Materials Legend shall accompany the color boards to aid in clearly identifying all finishes. Clarification of finish placement shall be required when more than one color of a single finish is proposed. A minimum of two sets shall be supplied to the government.

### 1.7.4 Drawings

Sixty percent architectural drawing submittal shall be a complete set of

architectural drawings meeting the requirements regarding dimensioning, scales, and formatting as described in paragraph 1.5.1 of this specification. For interior design purposes the drawings shall include:

#### 1.7.4.1 Floor Plans

The overall and expanded floor plans shall locate and show the following scaled items:

- A. Plumbing fixtures.
- B. Kitchen equipment.
- C. Cabinets, counters, and casegoods.
- D. Furniture Plan showing location of all proposed furniture.

#### 1.7.4.2 Interior Elevations

Fully dimensioned interior elevations shall be provided of all walls or partial wall areas required to visually and dimensionally locate interior architectural materials, finishes, cabinetry, or equipment. Interior elevations shall include symbology for required detail cross sections.

#### 1.7.4.3 Schedules and Legends

Provide a fully edited interior room finish schedule in the COE format provided. Provide a 60 percent complete Interior Finish Materials Legend in the COE format provided.

#### 1.7.4.4 Furniture-Related Design

Provide a three ring binder preliminary presentation to include illustrations, specifications, and procurement information on proposed furniture and accessory selections. All items should be coded and cross-referenced to the furniture floor plan.

### 1.8 STRUCTURAL

#### 1.8.1 DRAWINGS

Drawings shall include roof framing plans, floor slab plans and foundation plans for buildings. Roof framing plans shall show sufficient details to clearly indicate the type of framing system used, size and spacing of members and their elevations. The location of all columns or pilasters shall be shown, and all building structural members shall be at least outlined. The sizes, locations and elevations of footings shall be shown. Slab plans shall be coordinated with the Architectural sheets and shall indicate the locations of structural walls and masonry partitions, recessed slabs and contraction or construction joints. Concrete slab-on-grade thicknesses and sections shall be shown. Proposed treatment of unique or complex features and details shall be shown on the drawings. Elevation views, sections and details necessary to illustrate the design at a 60% level of completion shall be provided. Drawings shall also include overall building plan dimensions, north arrows, and design notes. Drawings shall be done at a scale appropriate for the design, in no case however, shall plan type drawings be done at a scale smaller than 1:100 or detail type drawings at a scale smaller than 1:20.

### 1.8.2 SPECIFICATIONS

For this 60% design submittal the Contractor shall provide a listing by title and number of all Technical Specifications proposed for use in the final structural design.

### 1.8.3 DESIGN ANALYSIS NARRATIVE

The design analysis shall include all items included in the 35% submittal expanded as necessary to reflect the current stage of the project and any revisions necessitated by comments on the Concept submittal. Design analysis shall follow the format described in Section 01331 SUBMITTALS DURING DESIGN, Paragraph 3.3, "Design Analyses" and the specific content shall be essentially as outlined below.

#### 1.8.3.1 Design Criteria and References

A list of design criteria references, such as Department of the Air Force Manuals, Army Corps of Engineers Technical Instructions, ACI Standards, AISC Specifications, etc., and any other references which were used in the design of the project shall be included in the narrative.

#### 1.8.3.2 Design Loads and Conditions

A list of structural design loads and conditions shall be provided, including:

- Snow load parameters;
- Wind load parameters
- Seismic design parameters;
- Roof live loads;
- Floor live loads, identifying each loading with usage and the room or space where used;
- Foundation design criteria, including the design depth for footings, allowable soil bearing pressure, equivalent fluid densities (or lateral earth pressure coefficients) for the design of earth retaining structures and building components, modulus of subgrade reaction, and any other pertinent data derived from the recommendations of the Final Foundation Analysis report (See Attachment No. 2 included as an appendix to this solicitation), a copy of which shall be included as an Appendix to the design analysis.

#### 1.8.3.3 Structural Materials

A list of structural materials shall be provided, together with the stress grades and/or ASTM designations, as applicable, for structural steel, concrete, and reinforcing steel; the series for steel joists; and identification of the proposed use of each material in the structure.

#### 1.8.3.4 Availability of Precast Concrete Units

Where precast concrete units of particular cross section(s) and concrete strength are a part of the structural design, verification of their availability from precast producers in the project vicinity shall be documented. Acceptable documentation consists of letters from the producers or a written statement by the Contractor identifying the name and address of the precaster(s), description of units and concrete strength(s) available, date when availability was verified, and name of Contractor's staff member who obtained the verification.

#### 1.8.3.5 Description of the Structural System

A concise description of the proposed structural systems selected for the building, together with the reasons for its selection, shall be provided. All principal elements of the structural system selected shall be described. Typically, these shall include:

- Primary supporting members for the roof;
- Masonry walls, type of material, and whether load bearing or non-load bearing, with location of load-bearing walls defined, and measures taken to compensate for expansion/contraction and crack control in masonry walls;
- The proposed system for resisting lateral forces (wind and earthquake) and transferring them to the ground, whether diaphragms, chord bracing, shear walls, braced or moment resisting frame, etc;
- Foundations, description of special designs to accommodate existing site conditions;
- Concrete slab-on-grade floors, description of floor surface finish treatment, accommodation of live loads, and the use, location and types of crack control joints;
- The proposed treatment of any unusual structural loadings, features or unique solutions to structural problems.
- Identification of any major vibrating elements and measures taken to isolate them.

#### 1.8.4 DESIGN ANALYSIS CALCULATIONS

The extent of the structural calculations shall be indicative of a design which has reached a 60% level of completion. Computations shall include the determination of snow, wind, seismic, dead and live loads. Computations shall show sizing and spacing of structural members for roof framing, sidewalls and foundation sizes, as appropriate to the systems to be used for these elements.

#### 1.9 MECHANICAL

Compliance with the design requirements for the building mechanical systems will be determined by a review of the submitted 60 percent design analysis, design calculations, drawings and specifications. The 60 percent design submittal shall include all the information presented in the 35 percent submittal, updated to 60 percent design status, corrected to reflect any changes made in response to review comments, and shall include the additional requirements specified hereinafter. Any conflicts in the design requirements or lack of thorough understanding of the nature and scope of work shall be identified and resolved prior to submittal of the 60 percent design.

##### 1.9.1 DESIGN ANALYSIS NARRATIVE

The 60 Percent Design Analysis Narrative shall include the information presented in the 35 percent submittal and as specified in Section 01019, 35 PERCENT DESIGN REQUIREMENTS. The information shall be corrected to reflect changes in content made in response to review comments, and shall be expanded to reflect the 60 percent design.

##### 1.9.2 CALCULATIONS

The 60 percent calculations shall include all the information presented in the 35 percent submittal and as specified in Section 01019, 35 PERCENT DESIGN REQUIREMENTS, shall be corrected to reflect changes in content made in response to review comments, and shall be expanded to reflect the 60 percent design. The design analysis calculations shall include the heating, cooling, and ventilation load calculations to determine the selection of the type and size of mechanical equipment to be used. Design calculations shall be provided in sufficient detail to enable the reviewer to get a clear understanding of all work to allow approval. Backup data shall be furnished to support basic design decisions related to sizing of major equipment and materials, performance of specific systems or equipment. Manufacturer's catalog data sheets shall be provided for each item of equipment selected. Calculations shall be performed by computerized procedures as specified in Section 01016, MECHANICAL REQUIREMENTS. Use of standardized charts, curves, tables, graphs shall not be acceptable for portions of required calculations in lieu of specific calculation procedures, except when the charts, curves, tables, and/or graphs are part of the manufactures' proprietary published selection procedure/data to determine the output capacity, pressure drops, etc of the equipment being selected. Design calculations and computations shall be provided for all systems and shall include, but not limited to, the following:

#### 1.9.2.1 Block Air-Conditioning Loads

Preliminary block load calculations as specified in Section 01016, MECHANICAL REQUIREMENTS for boiler selection. A copy of all input and output printouts for all three design conditions shall be provided.

#### 1.9.2.2 Deleted Paragraph

#### 1.9.2.3 Deleted Paragraph

#### 1.9.2.4 Boiler Selection

Include boiler capacity adjustments for altitude, inefficiency, and net rating. Provide catalog data indicating input capacity, net output capacity, number of modules, dimensions, and water and intake and exhaust size connections.

#### 1.9.2.5 Combustion-Air Requirements

Include combustion air quantity and free area calculations for all indirectly vented gas burning appliances, louver selection, combustion air heating requirements, and selection of heating equipment.

#### 1.9.2.6 Air Handling Units

Air handling unit selection including selection of all filters, mixing boxes, access sections, fan section, coils and coil sections in accordance with the manufacturer's published selection procedures and/or the manufacturer's selection software. Provide catalog data indicating flow rate volumes, coil capacity and water flow rates, number of modules, dimensions and connection sizes. All selections shall be relatively final except for the fan sizing.

#### 1.9.2.7 Blower Coil Units

Blower coil unit selection including selection of all filters, access sections, fan section, coils and coil sections in accordance with the manufacturer's published selection procedures and/or the manufacturer's selection software. Provide catalog data indicating flow rate volumes, coil capacity and water flow rates, dimensions and connection sizes. All selections shall be relatively final except for the fan sizing.

#### 1.9.2.8 Computer or Fan Coil Unit

Selection of the unit for the communication rooms including selection of all filters, access sections, fan section, heating coil and DX coil in accordance with the manufacturer's published selection procedures and/or the manufacturer's selection software. Provide catalog data indicating flow rates, coil capacity, dimensions and connection sizes. All selections shall be relatively final except for the fan sizing.

#### 1.9.2.9 Make Up Air Unit

Make up air unit selection including selection of all filters, access sections, fan section, coils and coil sections in accordance with the manufacturer's published selection procedures and/or the manufacturer's selection software. Provide catalog data indicating flow rate volumes, coil capacity and water flow rates, dimensions and connection sizes. All selections shall be relatively final except for the fan sizing.

#### 1.9.2.10 Unit Heater Selections

For each area requiring a unit heater, provide data on capacity, flow rates, pressure drops, weight, and horsepower.

#### 1.9.2.11 Waste and Vent Pipe Sizes

Provide preliminary riser diagrams with fixture type, fixture units and resultant pipe sizes.

#### 1.9.2.12 Domestic Water Demand

Calculations for determining the size of the domestic cold water supply line to the building shall be provided.

#### 1.9.2.13 Domestic Pipe Sizes

Provide preliminary riser diagrams with fixture type, fixture units and resultant pipe sizes. In addition to the pipe sizes provide a summary of the pressure drops and available pressure from the service entrance to the most hydraulically remote fixture that demonstrates the pressure required by the fixture is met.

#### 1.9.2.14 Domestic Hot Water Demand

The design guidance provided for service water heating in ASHRAE Handbook HVAC Systems and Applications shall be followed to determine the domestic hot water demand for the facility as specified in Section 01016, MECHANICAL REQUIREMENT. Provide calculations and catalog data for the domestic water heaters and storage tanks.

#### 1.9.2.15 Pipe Sizes for Internal Roof Drains

If any internal roof drains are provided, then provide preliminary riser

diagrams with drain type, estimated flow and resultant pipe sizes as specified in Section 01016, MECHANICAL REQUIREMENT.

#### 1.9.2.16 Natural Gas Pipe Sizes

Provide preliminary riser diagrams with appliance type, input rating and resultant pipe sizes as specified in NFPA 54 and section 01016, MECHANICAL REQUIREMENT.

#### 1.9.2.17 Hydraulic Calculations for Fire Protection

Hydraulic calculations for the wet pipe sprinkler system, including a drawing showing hydraulic reference points and pipe segments.

#### 1.9.2.18 Load Calculations for Sizing Sway Bracing

For wet pipe sprinkler systems that are required to be protected against damage from earthquakes, load calculations shall be provided for sizing of sway bracing.

#### 1.9.2.19 Estimated Preliminary Calculations

Segment by segment calculations of pressure drop for piping and ductwork need not be submitted at the stage except for items to be Fast Tracked. Any additional preliminary calculations shall be provided to estimate pressure drop in pump and fan selections, pipe and duct sizes and expansion tank sizing shall be submitted for review.

#### 1.9.2.20 Electrical Load Summary

A summary of all mechanical equipment and the associated electrical load requirements shall be provided.

#### 1.9.2.21 Mechanical Items to be Fast Tracked

All final calculations as specified above, in section 01020, 60 PERCENT DESIGN REQUIREMENTS, in section 01021, 100 PERCENT DESIGN REQUIREMENTS and in section 01016, MECHANICAL REQUIREMENTS shall be submitted, reviewed and approved to accurately and clearly identify the final requirements for every piece of mechanical, HVAC and/or plumbing equipment to be installed before the full facility design is complete and approved prior to the installation of the subject item.

#### 1.9.2.22 Site, Architectural and Structural Items to be Fast Tracked

Prior to the installation of any structural foundations the size of the mechanical room shall be verified and all piping to be installed below the slab on grade floor shall be fully designed and approved as specified above, in section 01020, 60 PERCENT DESIGN REQUIREMENTS, in section 01021, 100 PERCENT DESIGN REQUIREMENTS and in section 01016, MECHANICAL REQUIREMENTS. All final calculations as specified above, in section 01020, 60 PERCENT DESIGN REQUIREMENTS, in section 01021, 100 PERCENT DESIGN REQUIREMENTS and in section 01016, MECHANICAL REQUIREMENTS shall be submitted, reviewed and approved to accurately and clearly identify the final requirements, including all maintenance clearances, for every piece of mechanical, HVAC and/or plumbing equipment to be installed within the foot print of the mechanical room and all piping to be installed below the slab on grade floor. When grading or building surface is to be fast tracked, then all final calculations as specified above, in section 01020,

60 PERCENT DESIGN REQUIREMENTS, in section 01021, 100 PERCENT DESIGN REQUIREMENTS and in section 01016, MECHANICAL REQUIREMENTS shall be submitted, reviewed and approved to accurately and clearly identify the final requirements for every mechanical, HVAC and/or plumbing distribution system that penetrates the installed grading or surface prior to the installation of the subject grading or surface.

### 1.9.3 CONSTRUCTION DRAWINGS

The drawings shall be fully coordinated with the design analysis and specifications. Provide sufficient plans, piping diagrams and isometrics, sections, air and water flow diagrams, details, schedules, and control diagrams/sequences of operation etc. shall be provided as necessary to define the required design intent and requirements. The designer shall show on the construction drawings all items which are referred to with phrases such as "as shown", "as indicated", "as detailed", etc within the UFGS Specifications. The construction drawings shall show, to scale, the actual equipment to be installed and all required clearances required for operation, routine maintenance, and replacement of minor and major components. The drawings shall not show any piping, ductwork or other mechanical equipment to be exposed in finished spaces except where approved by the government. All exposed items shall be called out to the government for approval before proceeding. Access panels required for concealed items shall be shown on the construction drawings. The design and installation shall be fully coordinated with all other trades involved in the design and construction of the facility. Special care shall be given to National Electric Code requirements for clearance in front of and above electrical equipment. The construction drawing shall be produced to incorporate the requirements below into all drawings. Furthermore, the requirements below shall be repeated in the form of general notes on every mechanical (both HVAC and plumbing) construction drawing that shows a plan view. General notes shall include any mechanical general installation notes that may be required to clarify the construction intent that may not be readily apparent in the specifications or on the drawings. General notes may be provided on a separate sheet if space does not exist on the plan sheets. Sheet reference number sequencing shall be in accordance with the A/E/C CADD Standards Manual, ERDC/ITL TR-01-6. Submittal drawings shall include, but not limited to, the following:

#### 1.9.3.1 Drawing Clarity

All drawings specified below, when reproduced at half scale, shall be clear and easily readable as determined by the Contracting Officer's Representative (COR).

#### 1.9.3.2 Drawing Coordination

Show on all mechanical drawings specified below, all items of mechanical equipment and systems, to determine proper space allocation within the limits of the architectural, structural and electrical layout requirements. Plans, elevations, and sections shall be developed sufficiently to insure that major equipment items, piping, and ductwork cause no interference with architectural members, structural members, electrical equipment, etc.

#### 1.9.3.3 Index Sheet

An index sheet identifying all mechanical drawings shall be provided, including those drawings anticipated to be provided in the 100 percent design submittal. Index shall include drawing design file numbers, drawing

numbers, sheet numbers, and drawing descriptions.

#### 1.9.3.4 Legend Sheet

This sheet shall include all mechanical abbreviations and symbols that will be used on the drawings. Symbols shall be grouped into sections; as a minimum, provide sections for Plumbing, Heating, Miscellaneous Piping, Valves and Fittings, and ventilation.

#### 1.9.3.5 Plumbing Plan Sheets

Floor plans shall use the architectural floor plans as a basis, with the building outline half-toned. Unless otherwise indicated, all floor plans shall be drawn at 1:50 scale and shall show all room names and numbers. Coordinate with architectural design for provisions of access panels for all concealed valves, traps, fire dampers and air vents etc.. Coordinate with architectural design so that louvers shown on architectural drawings match damper sizes for the respective openings as shown on Mechanical drawings. An exception to this are mechanical room plans shall be 1:20 scale.

Plumbing plans showing the design and tentative layout of the domestic hot and cold water distribution systems; make-up water piping; soil, waste and vent piping; and storm water drainage system shall be provided. Plans shall show all anticipated routing of piping systems from the connections within the structure to a point 5 feet outside the structure. The grade of all drain lines shall be calculated and invert elevations established. All electrical panels/equipment and pertinent HVAC equipment (expansion tanks, boilers, AHU's, pumps, etc.) shall be outlined in half-tone on the plumbing plans. Plumbing fixtures and drains shown on the drawings shall be designated by the same identification system used in the Technical Specification and Plumbing Fixture Schedule.

#### 1.9.3.6 Enlarged Mechanical Room Plumbing Plan

An enlarged mechanical room plumbing plan drawn at a minimum 1:20 scale shall be provided. Plan shall show layout of all plumbing equipment and piping within the rooms. Mechanical room piping, ductwork and equipment shall be installed to provide a minimum headroom of 2 m below all overhead mechanical room piping, ductwork and equipment. Aluminum jackets shall be provided over all insulation installed within 1500 mm of the mechanical room floor. In addition to all the plumbing systems required, the plan shall show half-toned outlines of all HVAC equipment located in the room, gas service, the fire protection entrance and risers, and the outline of any electrical panels or equipment located in the room.

#### 1.9.3.7 Enlarged Kitchen Plumbing Plan

An enlarged Kitchen plan drawn at a minimum of 1:20 scale shall be provided. Plan shall show layout of all plumbing equipment and piping within the rooms. In addition to all the plumbing required, the plan shall show half-toned outlines of all HVAC equipment located in the room, gas service the fire protection and the outline of any electrical panels or equipment located in the rooms.

#### 1.9.3.8 Plumbing Detail Sheets

Installation details showing all specification requirements such as isolation and balancing valves, thermometers, pressure gauges, equipment

pads, strainers, vents, hangers, vibration isolation, etc. shall be provided for each item of plumbing equipment. Details shall be provided in the construction drawings for each piece of equipment such as pumps, water heaters, water service entrance, and other similar items. Details shall clearly show all requirements specified in this section and the Technical Specifications.

#### 1.9.3.9 Plumbing Schedule Sheet

Schedules, with preliminary capacities, shall be provided for each item of plumbing equipment. At a minimum, a plumbing fixture schedule and a water heater schedule shall be provided.

#### 1.9.3.10 Plumbing Riser Sheet

Plumbing Riser Diagrams showing all fixtures, water, waste, and vent piping shall be provided for the mechanical equipment room, kitchen, laundry and each toilet area including janitor's closet.

#### 1.9.3.11 Enlarged Mechanical Equipment Yard Plan

An enlarged mechanical equipment yard plan drawn at a minimum of 1:20 scale shall be provided. Plan shall show layout of all mechanical equipment and piping within the space. In addition to all the mechanical required, the plan shall show half-toned outlines of all electrical panels or equipment located in the space.

#### 1.9.3.12 HVAC Plan Sheets

Floor plans shall use the architectural floor plans as a basis, with the building outline half-toned. Unless otherwise indicated, all floor plans shall be drawn at 1:50 scale and shall show all room names and numbers. Coordinate with architectural design for provisions of access panels for all concealed valves, traps, fire dampers and air vents etc.. Coordinate with architectural design so that louvers shown on architectural drawings match damper sizes for the respective openings as shown on Mechanical drawings. An exception to this are mechanical room plans shall be 1:20 scale.

Mechanical HVAC plans showing the design and tentative layout of the hot water piping distribution system and equipment, the chilled water piping distribution system and equipment, the air supply and distribution systems and equipment, and the ventilation and exhaust systems and equipment shall be provided. Air supply and distribution systems shall show all ductwork, including supply and return ductwork, ductwork to diffusers, and all diffusers. Use of flexible ductwork shall be limited to a maximum length of 2 m. Where ductwork must be offset to cross another duct, the duct with the lowest velocity shall be offset. Ductwork offsets shall not be greater than 30 degrees unless the designer has shown the offset and included it in the duct systems calculations. The designer shall indicate the duct pressure classification for each duct segment on the construction drawings.

All ductwork shall be sealed to seal class A. For the 60 percent submittal, all ductwork may be shown as single-lined. The final design submittal shall show all ductwork as double-lined. All electrical panels/equipment and pertinent plumbing equipment shall be outlined in half-tone on the HVAC plans.

#### 1.9.3.13 Mechanical Sections

For each air handling unit and for congested areas where the proximity of mechanical, HVAC, plumbing and electrical items, equipment and/or distribution system require vertical spatial definition, a mechanical section view shall be provided showing, but not limited to, all AHU or other equipment components, ductwork and piping connections/routing, and relationship to adjacent architectural, structural and electrical features.

#### 1.9.3.14 Enlarged Mechanical Room HVAC Plan

An enlarged mechanical room HVAC plan drawn at a minimum 1:20 scale shall be provided. Plan shall show layout of all mechanical systems, HVAC equipment, piping, and ducts within the rooms. Equipment shall include (but not limited to) air handling units with associated outside air intakes, relief air, and supply/return ducts; exhaust/supply fans, mechanical room ventilation intake/relief openings, gas service entrance, combustion air opening (if required), unit heaters, HW pumps, CW pumps, boilers, air separators, expansion tanks, water treatment and temperature control panels. Openings for relief air and outside air shall be coordinated with size of architectural louver. Plans shall show dedicated access space for items requiring maintenance. Mechanical room piping, ductwork and equipment shall be installed to provide a minimum headroom of 2 m below all overhead mechanical room piping, ductwork and equipment. Aluminum jackets shall be provided over all insulation installed within 1500 mm of the mechanical room floor. In addition to all the HVAC systems required, the plan shall show half-toned outlines of all plumbing equipment located in the room, gas service, the fire protection entrance and risers, the water service entrance, and the outline of any electrical panels or equipment located in the room.

#### 1.9.3.15 Enlarged Kitchen HVAC Plan

Enlarged Kitchen plans showing all mechanical systems and drawn at a minimum 1:20 scale shall be provided. Plans shall show layout of all equipment, piping, and ducts located within the rooms. Equipment shall include (but not be limited to) air handling units with associated outside air intakes, relief air, and supply/return ducts; exhaust/supply fans, condensate hoods and grease hoods. Plans shall show dedicated access space for items requiring maintenance. In addition to all the mechanical HVAC systems required, the plan shall show half-toned outlines of all major plumbing equipment, and any electrical equipment or panels located in the room.

#### 1.9.3.16 Mechanical Detail Sheets

Installation details showing all specification requirements such as isolation and balancing valves, thermometers, pressure gauges, equipment pads, strainers, vents, hangers, vibration isolation, etc. shall be provided in the construction drawings for each piece of equipment such as pumps, air handling units, heating or cooling coils, in-line fans, propeller fans, exhaust hoods, relief hoods or penetrations, unit heaters, expansion tanks, chemical shot feeders, boilers, chillers, fluid coolers, and other similar items. Pressure gauges shall be installed on each side of each piece of equipment such as pumps, heating or cooling coils, boilers, chillers, fluid coolers, and other similar items. Pressure gauges located on the return side of coils shall be located between the coil and the control valve. Thermometers shall be installed on each side of each piece of equipment such as heating or cooling coils, boilers, chillers, fluid coolers, and other similar items. Thermometers in horizontal lines shall be installed with stems horizontal or above. Thermometers located on

the return side of coils shall be located between the coil and the control valve. Details shall clearly shown all requirements specified in either in this section or the Technical Specifications.

#### 1.9.3.17 Mechanical Schedule Sheets

Schedules, with equipment type, sizes, dimensions, capacities (both input and output), all velocities, all pressure drops, all input and output temperatures, all volume flow rates, rotational speed, efficiencies, noise criteria and electrical data as a minimum shall be provided for each item of mechanical equipment. Preliminary schedules shall be revised and completed as necessary to suit the project requirements.

#### 1.9.3.18 Combined Enlarged Mechanical Plan

Where separate plans have been specified above for the plumbing, HVAC and other mechanical requirements with the other disciplines specified to be shown half-toned, a single combined plan maybe provided if all other requirements specified above are meet including drawing clarity. The plan shall show half-toned outlines of all major architectural, structural and electrical items and clearances located in the room.

#### 1.9.3.19 Wet Pipe Sprinkler System Drawings

The Sprinkler System Shop Drawings shall conform to the requirements established for working plans as prescribed in NFPA 13. Drawings shall include plan and elevation views demonstrating that the equipment will fit the allotted spaces with clearance for installation and maintenance.

a. Floor plans drawn to a scale not less than 1:100 which clearly show locations of sprinklers, risers, pipe hangers, seismic separation assemblies, sway bracing, inspector's test connections, drains, and other applicable details necessary to clearly describe the proposed arrangement. Each type of fitting used and the locations of bushings, reducing couplings, and welded joints shall be indicated.

b. Actual center-to-center dimensions between sprinklers on branch lines and between branch lines; from end sprinklers to adjacent walls; from walls to branch lines; from sprinkler feed mains, cross-mains and branch lines to finished floor and roof or ceiling. A detail shall show the dimension from the sprinkler and sprinkler deflector to the ceiling in finished areas.

c. Longitudinal and transverse building sections showing typical branch line and cross-main pipe routing as well as elevation of each typical sprinkler above finished floor.

d. Details of each type of riser assembly; pipe hanger; sway bracing for earthquake protection, and restraint of underground water main at point-of-entry into the building, and electrical devices and interconnecting wiring.

#### 1.9.3.20 Mechanical Items to be Fast Tracked

All final drawings including fully edited and coordinated control drawings as specified above, in section 01019, 35 PERCENT DESIGN REQUIREMENTS, in section 01021, 100 PERCENT DESIGN REQUIREMENTS and in TI 810-11 shall be submitted, reviewed and approved to accurately and clearly identify the

final requirements for every piece of mechanical, HVAC and/or plumbing system, equipment and the final control requirements for every piece of HVAC equipment to be installed before the full facility design is complete and approved prior to the installation of the subject item.

#### 1.9.3.21 Site, Architectural and Structural Items to be Fast Tracked

Prior to the installation of any structural foundations the size of the mechanical room shall be verified and all piping to be installed below the slab on grade floor shall be fully designed and approved as specified above, in section 01019, 35 PERCENT DESIGN REQUIREMENTS, in section 01021, 100 PERCENT DESIGN REQUIREMENTS and in section 01016, MECHANICAL REQUIREMENTS. All final drawings as specified above, in section 01019, 35 PERCENT DESIGN REQUIREMENTS, in section 01021, 100 PERCENT DESIGN REQUIREMENTS and in section 01016, MECHANICAL REQUIREMENTS shall be submitted, reviewed and approved to accurately and clearly identify the final requirements, including all maintenance clearances, for every piece of mechanical, HVAC and/or plumbing equipment to be installed within the foot print of the mechanical room and below the slab on grade floor. When grading or building surface is to be fast tracked, than all final drawings as specified above, in section 01019, 35 PERCENT DESIGN REQUIREMENTS, in section 01021, 100 PERCENT DESIGN REQUIREMENTS and in section 01016, MECHANICAL REQUIREMENTS shall be submitted, reviewed and approved to accurately and clearly identify the final requirements for every mechanical, HVAC and/or plumbing distribution system that penetrates the installed grading or surface prior to the installation of the subject grading or surface.

#### 1.9.4 SPECIFICATIONS

The submitted 35 percent technical guide specifications shall be updated, completely edited, and fully coordinated with the drawings to accurately and clearly identify the 60 percent product and installation requirements for the facility. Technical specifications shall be Unified Facilities Guide Specifications (UFGS), which shall be completely edited and fully coordinated with the drawings to accurately and clearly identify the product and installation requirements for the facility as specified in Section 15000, DIVISION 15: MECHANICAL - OUTLINE SPECIFICATIONS. The UFGS specifications define the minimum requirements for items of equipment, materials, installation, training, operating and maintenance instructions, O&M manuals and testing that shall be provided for the facility. All UFGS specification indexes shall be completely edited to reflect the paragraphs retained in the body of the technical specification. All references that have not been used in the body of the technical specification shall be edited from the UFGS specification. Technical specifications shall be coordinated with the plans and include all items contained within the project. Provide special sections to cover those subjects for which no UFGS guide specification is available. Specific items of equipment identified in the UFGS specifications but not required for the facility shall be edited out. All edited UFGS guide specifications, to be provided, shall be in edited form showing all text to be deleted and added. Government conformance review is required for any specification addition or deletion.

##### 1.9.4.1 Items to be Fast Tracked

Fully edited and coordinated technical guide specifications as specified above and in Section 15000, DIVISION 15: MECHANICAL - OUTLINE

SPECIFICATIONS shall be submitted, reviewed and approved to accurately and clearly identify the final product and installation requirements for every item to be installed before the design is complete and approved prior to the installation of the subject item.

## 1.10 ELECTRICAL

### 1.10.1 Drawings

Drawing scale shall match architectural drawing requirements. Drawings shall show the following:

#### 1.10.1.1 Lighting Layout and List of Fixtures

Complete lighting layout of all areas shall be provided. The type of fixture shall be indicated on the drawing. Complete list of fixtures proposed with type of lamp and wattage.

#### 1.10.1.2 Receptacle Layout

Complete receptacle layout should be provided for all areas to indicate project requirements.

#### 1.10.1.3 Power Equipment and Layout

Power equipment and layout such as switchgear, panelboards, large motor driven items, etc.

#### 1.10.1.4 Power One Line Diagram

Power one line diagram shall be shown to indicate arrangement of the system.

#### 1.10.1.5 Communications

Communications (telephone, public address) shall be shown sufficiently to indicate the designers understanding of the Section 01007 ELECTRICAL REQUIREMENTS.

#### 1.10.1.6 Fire Detection

Fire Detection drawings shall be provided and inserted in the Fire Protection/Fire Suppression F-Series of drawings.

#### 1.10.1.7 Miscellaneous Details of Special Equipment

Miscellaneous details of special equipment to indicate understanding of 01007 ELECTRICAL REQUIREMENTS.

### 1.10.2 Specifications

Submit prescriptive specification sections to specify the quality, characteristics, installation procedures and testing requirements for all items of the proposed electrical design.

Specifications shall be provided (to approximately 60 percent completion).

See Section 01332 SUBMITTALS DURING DESIGN, paragraph 3.2, SPECIFICATIONS for additional requirements.

### 1.10.3 Design Analysis Narrative

The design analysis shall contain a description and analysis of the electrical portions of the design. Special features, unusual requirements, etc., should be noted. Narrative must address all technical requirements identified in Section 01007 ELECTRICAL REQUIREMENTS.

#### 1.10.4 Design Analysis Calculations

Backup data shall be furnished to support basic design decisions related to sizing of major equipment and materials. As a minimum the following shall be submitted.

##### 1.10.4.1 Service

Sizing of building services EMD (Estimated Maximum Demand) for all the building loads.

##### 1.10.4.2 Transformers

Sizing of general purpose dry type transformers.

##### 1.10.4.3 Feeders

Sizing of main feeders.

##### 1.10.4.4 Panelboards

Sizing of panelboards and distribution equipment.

##### 1.10.4.5 Illumination Calculations

Data should identify target and calculated illumination levels for all typical rooms. Calculations should be adjusted to compensate for special applications such as irregularly shaped rooms, open sides, ceiling obstructions (beams, ductwork), corridors, etc. If the lumen method is used for corridor calculations, the calculations should be performed using a module in which the length doesn't exceed 3 times the width (2:1 ratio preferred).

##### 1.10.4.6 Short Circuit Evaluation

The maximum possible fault current at the building service should be calculated.

##### 1.10.4.7 Sustainable Design

The Design Analysis shall include the proposed sustainable design objectives with reference to electrical systems, equipment, lighting, and design work which will be attained as part of this project.

#### 1.11 FIRE PROTECTION

##### 1.11.1 DRAWINGS

Features of Fire Protection, their ratings, and the hazards requiring them, shall be clearly indicated. Sprinkler and fire alarm/detection areas shall also be clearly indicated. Fire detection and sprinkler systems shall be laid out and detailed sufficiently to indicate the designers understanding of the Section 01008 FIRE PROTECTION REQUIREMENTS. When other functions

co-exist with the fire protection functions, their integration shall be clearly indicated, with an analysis that describes how both functions will be served. Provide a separate, composite type floor plan which makes an accurate presentation of these various features and functions. As part of the submittal, provide a set of plans that shows emergency egress for the facility.

#### 1.11.2 DESIGN ANALYSIS

The design analysis shall include a separate fire protection report containing, but not limited to, review statements and/or comments on the following items, where applicable.

- a. Location and rating of fire walls and fire partitions.
- b. Column, floor, and roof protection.
- c. Path of travel for emergency egress and operation of panic exits.
- d. Access to building for fire fighting.
- e. Design and placement of fire and smoke stop doors.
- f. Labeled windows, where required.
- g. Venting of smoke.
- h. Placement of hand fire extinguisher cabinets.
- i. Type and adequacy of sprinkler system.
- j. Building exterior fire protection facilities and building clearances.
- k. Type of occupancy.
- l. Zoning of fixed fire protection systems.
- m. Type and adequacy of fire alarm and detection systems.
- n. Zoning of fire alarm and detection systems.
- o. Number of zones of alarm and detection systems that are separately transmitted to the base or installation fire department.
- p. Type of Construction.
- q. Height and area limitation.
- r. Flame-spread and smoke-developed ratings.
- s. Water supplies for fire protection.

#### 1.11.3 TECHNICAL GUIDE SPECIFICATIONS

None of the UFGS guide specifications are required to be submitted at this design stage. However; any Contractor generated specifications required to meet the project specifics, or individual specification items added to the provided guide specifications shall be submitted for review. Note that guide specifications 13930, WET PIPE SPRINKLER SYSTEMS, FIRE PROTECTION and

13851, FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE are required for this contract. As such they may be edited only for those portions that do not apply to this project. Note that this applies only to equipment items. Testing, qualifications, submittal requirements, etc., may not be modified or deleted. For the equipment items that do apply, no changes may be made.

#### 1.12 ENVIRONMENTAL PROTECTION, COMPLIANCE, AND PERMITS

Specification Section 01410, ENVIRONMENTAL PROTECTION, COMPLIANCE, AND PERMITS furnished with Division 1 of this RFP, contains requirements presently known to be required for environmental protection, compliance, and permits. It is the Contractor's responsibility to provide any additional requirements to ensure that the project is in full environmental compliance with Federal, State, Regional and local laws and regulations. All new environmental requirements shall be submitted with the 60% Design Review Submittal.

##### 1.12.1 Design Analysis Chapter

The Contractor shall prepare a chapter in the Design Analysis entitled: "ENVIRONMENTAL PROTECTION, COMPLIANCE, AND PERMITS". This chapter shall include a summary of environmental coordination, compliance, approvals, permits, and etc. required for the project. The Contractor shall include documentation of the coordinations, discussions, phone conversation records, and/or letters required to assure that the project is in full compliance with all Federal, State, Regional, and local environmental laws and regulations. A list of environmental permits, approvals, notifications, etc. that are required for the project shall be included.

##### 1.12.2 Draft Environmental Protection Plan

The Contractor shall prepare and submit a Draft Environmental Protection Plan in accordance with the requirements of Section 01410 ENVIRONMENTAL PROTECTION, COMPLIANCE, AND PERMITS. If additional environmental compliance plans are identified, during the design, the Contractor shall submit the additional environmental plans and/or attachments.

##### 1.12.3 Submittal of Environmental Permits, Notices, Reviews and/or Permit Applications and Associated Documents

As an Appendix to the Draft Environmental Protection Plan, the Contractor shall submit copies of all environmental permits, notices, reviews, and/or approvals that are required for the project. Copies of the applications and associated documents required by the the environmental permits, notices, reviews, and/or approvals shall be included in the Environmental Protection Plan Appendix.

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --

## SECTION 01021

## 100 PERCENT DESIGN REQUIREMENTS

## PART 1 100 PERCENT DESIGN SUBMITTALS

For general submittal requirements, see Section 01331 SUBMITTALS DURING DESIGN AFTER AWARD.

## 1.1 SITE PLANNING

***In addition to the following requirements the 100% submittal shall include incorporation of all comments from the 60% design.***

## 1.1.1 Drawings.

All approved comments from the 60 Percent Design Submittal shall have been incorporated. Cross-reference applicable sheets for items shown. Drawings required:

## 1.1.1.1 Location Plan and Vicinity Map

## 1.1.1.2 Construction Phasing Plans

## 1.1.1.3 Removal Plan

## 1.1.1.4 Site Plans

## 1.1.1.5 Site Details

## 1.1.1.6 Landscape Plans

## 1.1.1.7 Landscape Details

## 1.1.1.4 Utility Plans 1.1.1.4 Grading and Storm Drainage Plans

## 1.1.2 Specifications

a. Provide complete edited specifications for all items. Technical specifications shall be complete and fully coordinated with the drawings. All specification indexes shall be completely edited to reflect the paragraphs retained in the body of the specification. All references that have not been used in the body of the specification shall be edited from the technical specification.

b. Specifications shall be coordinated with the plans and include all items including seeding, sodding, trees and shrubs, and exterior furnishings. Special sections shall be prepared to cover those subjects for which no pattern guide specifications are available. All UFGS guide specifications, to be provided, shall be in edited form showing all text to be deleted and added.

## 1.1.3 Design Analysis Narrative

Design analysis shall include the following:

## 1.1.3.1 References

Provide design references used in preparing the site design.

### 1.1.3.2 Basis For Design

The Design Analysis should give the basis, specific goals, objectives and priorities for site design of the project. Identify, explain and document use of design criteria and how the design meets goals, objectives and priorities. Document pollution prevention measures and other environmental considerations made during the design process.

## 1.2 CIVIL

### 1.2.1 Drawings

#### 1.2.1.1 Grading and Drainage Plan

A final grading and drainage plan shall be provided at the same scale as the site plan. New and existing grading contours shall be indicated at one foot contour intervals. Indicate the finished floor elevation of all new buildings. Plans shall show the layout of the new and existing storm drainage and roof drainage systems. Uniform grades shall be labeled using slope arrows. Provide spot elevations at building corners, parking area corners, changes in grade, etc. Storm drainage lines and structures shall be labeled. The rim elevation of all manholes, curb inlets, and area inlets shall be indicated.

#### 1.2.1.2 Not Used

#### 1.2.1.3 Grading Sections

Provide as a minimum two grading sections (one east-west and the other north-south through the area of new grading work. These grading sections shall show new vs. existing grades, slopes of finished grades, finish floor elevations in the new building, and identification of main features such as parking areas, building, and walks.

#### 1.2.1.4 Roof Drain and Culvert Profiles

Provide profiles of all new culverts showing new and existing grades, new and existing utilities, pavement sections in detail, pipe diameters and lengths, pipe slopes, invert elevations, etc. Class and gauge of all culvert pipes shall be provided. This information may also be included in a Storm Drain Schedule drawing. Profiles of roof drain runout lines may or may not be provided, at the Contractor's discretion. However, invert elevations, lengths and pipe diameters of these roof drains shall be called out on the drawings.

#### 1.2.1.5 Drainage Structure Details

Provide typical details of all storm drainage structures.

#### 1.2.1.6 Pavement Details

Provide details of concrete curb and gutter, integral curb, typical pavement sections, typical sidewalk section, pavement utility cut details, and interface detail between new and existing pavement. Include pcc pavement, sidewalk, and curb and gutter joint plans and joint details.

#### 1.2.1.7 Erosion Control Details

Provide details of best management practices used to control erosion.

### 1.2.2 Specifications

Provide complete edited specifications for all items. Technical specifications shall be complete and fully coordinated with the drawings. All specification indexes shall be completely edited to reflect the paragraphs retained in the body of the specification. All references that have not been used in the body of the specification shall be edited from the technical specification.

### 1.2.3 Design Analysis Narrative

Design analysis shall include the following:

#### 1.2.3.1 References

Provide design references used in preparing the civil design.

#### 1.2.3.2 Grading

A narrative of the grading design and criteria used.

#### 1.2.3.3 Drainage

A narrative of the drainage design and criteria used. Include information on the storm drain pipe materials selected and their ability to withstand earth dead loads and live loads that will be imposed.

#### 1.2.3.4 Pavements

A narrative of the pavement design and criteria used.

### 1.2.4 Design Analysis Calculations

#### 1.2.4.1 Storm Drainage System Calculations

Storm Drainage System Calculations shall include the following:

- a. not used.
- b. not used.
- c. Tabulation of capacities of new storm drains including: diameter and slope of storm drain pipes, design storm discharge and velocity for each storm drain pipe, maximum discharge capacity of each storm drain pipe, headwater depth of each culvert during design storm discharge.
- d. Hydraulic capacity calculations for each new curb and area inlet.

#### 1.2.4.2 Pavement Design Calculations

Include all calculations, a complete copy of the software and manuals used in the design.

### 1.2.5 Storm Water Pollution Prevention Plan (SWPPP)

If construction activities results in disturbance of 1 acre of land or more, coverage under the **EPA Storm Water General Permit For Construction Activities** is required and the Contractor shall be responsible for complying with the requirements of **Specification Section 01356 STORM WATER POLLUTION PREVENTION MEASURES and KDHE requirements**. The Contractor and the Kansas City District Corps of Engineers shall be co-permittees. If coverage under the NPDES General permit is not required, Specification Section 01565 shall not be applicable. Not that since March 2003 two permits may be required, state/epa and local.

### 1.3 GEOTECHNICAL

Foundations, pavements and earthwork shall comply with the geotechnical report (or soils report).

#### 1.3.1 Drawings

##### 1.3.1.1 Soil Boring Locations

Foundation and pavement design recommendations included in the Final Soils Analysis Report (Attachment A) are based on soil borings obtained for this project. Drilling, sampling, and testing of subsurface soils was performed by the Kansas City District Corps of Engineers. Soil boring locations are shown on the Soil Boring Location Plan included with this RFP package.

##### 1.3.1.2 Soil Boring Log Sheet

Foundation and pavement design recommendations included in the Final Foundation Analysis Report (Attachment No. 2) are based on soil borings as discussed in paragraph 1.3.1.1. Soil boring logs are included with this RFP package.

#### 1.3.2 Design Analysis

The design and construction of building foundation, floor slab and pavement features shall comply with all requirements in the Geotechnical Report.

### 1.4 WATER SUPPLY AND WASTEWATER

#### 1.4.1 Drawings

Generally, the corrected and approved 60 percent plans may be used as the basis for the final plans. However, all details necessary for complete construction must be included. The 100 percent final design submittal shall include all the information presented in the 60 percent submittal, updated to final design status, corrected to reflect any changes made in response to review comments, and shall include the additional requirements specified hereinafter. Any concerns in developing the final design documents shall be resolved prior to starting the final design stage.

##### 1.4.1.1 Water Distribution and Sewage Collection Systems Plans (including building services)

Provide all existing utilities and above ground features, including sizes and material types, which may pose as an obstacle (i.e., water, sewer, gas, electrical, etc.) on the basic site plan layout. Indicate existing pipe material and sizes where new lines connect along with the type of connection and elevations of connections. Provide all new water and sewer lines with sizes. This will include all new service lines, up to within

the 5 foot building line. Locations of all new manholes, fire hydrants, valves (including PIV's), similar appurtenances, and connection points shall be provided. Show contours on plan view. Include stationing on both plan and profile sheets.

#### 1.4.1.2 Water Distribution and Sewage Collection Systems Profiles

Profiles of all gravity sewers and waterlines shall be provided. Profiles may be omitted for short waterlines, unless necessary to assure adequate cover or avoid interference with other underground facilities. Indicate existing pipe material and sizes where new lines connect. Indicate type of connection and elevation. Include all interference elevations.

#### 1.4.1.3 Water Distribution and Sewage Collection Systems Details

Appropriate water and sewer details shall be provided. The standard detail sheets will be furnished if required. For roadway pavement crossings, indicate installation method (open cut, boring, jacking, trenchless excavation, etc.). Include standard casing details.

#### 1.4.2 Specifications

Specifications shall be coordinated with the plans and include all items. Provide special sections to cover those subjects for which no UFGS guide specifications are used or available. These special sections shall include all approved changes from the 60 percent review stage. All UFGS guide specifications, to be provided, shall be in edited form showing all text to be deleted and added.

#### 1.4.3 Design Analysis Narrative

Design analysis shall include the following and all applicable data contained in the 60 percent design analysis narrative shall be repeated. References shall not be made to the previous design analysis. The final design analysis shall be corrected to reflect changes in content made in response to review comments, and shall be expanded to reflect the completed design.

##### 1.4.3.1 References

Provide design references used in preparing the water and wastewater design.

##### 1.4.3.2 Water Supply and Distribution Systems

A narrative of the water supply and distribution systems design and applicable criteria used shall be provided. Include the peak and average domestic demands, the interior and exterior fire flow requirements and the available flow and residual pressures. A description of the water distribution system, and complete calculations necessary to support equipment, piping sizes, interior and exterior fire demands, and domestic demands, etc. shall be provided.

##### 1.4.3.3 Wastewater and Sewers

A narrative of the wastewater supply design and applicable criteria used shall be provided. Include the average and peak contributing flows along with the available capacity and full flow capacity of the existing system. A listing of allowable piping materials, and complete calculations

necessary to support equipment and piping sizes shall be provided.

## 1.5 ARCHITECTURAL

### 1.5.1 Drawings

The drawings shall be complete, include all necessary and required details, thoroughly checked, and fully coordinated with the technical Specifications and all other Construction Documents. Previous comments and applicable criteria changes shall have been incorporated into the design. The contract drawings shall fully describe the type and the scope of work required. The layout of individual sheets and the organization of the assembled set shall follow and communicate a logical sequence. General information shall be presented first, progressing to more detailed information. When assembling details, begin in the upper left-hand corner of the sheet with letters progressing to the right and down. When dimensioning, use arrowheads, not dots or slashes. Where major structural elements are included as parts of architectural detailing, do not indicate sizes. These elements must be fully defined in the structural design documents. See 60% Architectural drawing submittal requirements for drawing scales of remaining drawings to be submitted. Include all drawings from the 60% submittal plus all additional detail drawings required for complete 100% design. These shall include but not be limited to the following:

- Door Details
- Window Details
- Louver Details
- Roof Details
- Stair Details
- Wall Plan Details and Plan Details
- Fire Wall Details and Penetration Conditions
- Sealant Details
- Ceiling Details
- Control/Expansion Joint Details
- All Miscellaneous Details

### 1.5.2 Technical Specifications

The technical specifications shall be complete and fully coordinated with the drawings. Special sections shall be prepared to cover those subjects for which no pattern guide specification is available. Notes to the Designer that accompany specifications shall be used in editing technical guide specifications. All specification indexes shall be completely edited to reflect the paragraphs retained in the body of the specification. All CEGS guide specifications shall be edited in accordance with Section 01331 SUBMITTALS DURING DESIGN.

### 1.5.3 Design Analysis Narrative

The Design Analysis shall include the basic information presented in the previous submittal, corrected to reflect changes in content made in response to review comments. Outline specifications shall be omitted from the Final Design Analysis as the information is included on the final drawings and project specifications. The design analysis shall be written in the present tense.

### 1.5.4 Design Analysis Calculations

The Design Analysis calculations shall include the basic information presented in the previous submittal, corrected to reflect changes in content made in response to review comments.

#### 1.5.5 Common Deficiencies

Some repeated errors have occurred in the preparation of design documents in the past. Subsequently these errors have been identified and the Contractor directed to make corrections. The work involved in such corrections becomes lost effort and time for the designer. Some of these errors which are most often overlooked include:

- a. Not using correct abbreviations or terminology on the drawings. Abbreviations must match what is used on the standard abbreviation sheet and terminology must match what is used in the standard technical guide specifications.
- b. Not using the correct scales, north arrow designation, section cut system, or incomplete dimensioning on the drawings. Missing graphic scales.
- c. Not providing sufficient space for door operation hardware at doors which swing into a wall running perpendicular to the opening. 100 mm minimum is required between edge of door frame and perpendicular walls.
- d. Not providing correct and complete Design Analysis information written in the present tense. The Design Analysis will be written following the format indicated herein. A separate Fire Protection section in the Design Analysis with input from all disciplines is one area which is often overlooked and shall be included.
- e. Not providing a structural stoop at exterior doors where the slab is at the same approximate elevation as the interior floor. The use of simple slabs on exterior grade leads to lifting of the slab in below-freezing temperatures which interferes with the safe operation of the door.
- f. Not correctly presenting or coordinating (to avoid interference) features of Fire Protection, Noise Control, and Physical Security.
- g. Not correctly referencing and cross referencing building sections, wall sections, details, etc.
- h. Failure to read/use technical notes in editing the Technical Guide Specifications.
- i. Failure to coordinate all disciplines prior to submittal of projects for review.
- j. Improper use of fire-retardant wood. Fire-retardant wood is combustible; its use in buildings that are of noncombustible construction is extremely limited (see UBC for the minor allowable uses). Because of the potential for severe degradation, fire retardant plywood shall not be used in a roof or roofing system, or in structural applications.
- k. Incorrectly listing trade names in door hardware

specifications in lieu of ANSI numbers and failure to correctly specify hardware finishes.

l. Control joints in CMU walls and brick expansion joints in face brick are not shown on both architectural plans, elevations and structural plans, or are inconsistent. Note also control joint locating and coordination for floor tile per Tile Council of America recommendations.

m. Failure to delete all publications which do not apply to the particular project.

n. North is not oriented the same direction on all sheets (civil, site, arch).

## 1.6 INTERIORS

### 1.6.1 Design Analysis/Narrative

Provide a complete and fully edited design analysis section for Interior Design. Updates as a result of the 60% review shall be made to the design analysis.

### 1.6.2 Technical Specifications

All appropriate UFGS guide specifications shall be provided for all materials used and shall be coordinated with the drawings and design analysis. Specifications shall be fully edited to identify proposed product and installation requirements. Where materials or installation requirements are not covered in the provided specifications, information shall be prepared to cover these items. In addition to guidance provided in specification Section 01331, SUBMITTAL PROCEDURES FOR DESIGN AFTER AWARD on editing technical specifications, data and sample submittals for all interior and exterior finishes (including but not limited to interior design and architectural specifications) shall be "AE" submittals. Fully edited specification sections shall include, but are not limited to all specification sections listed under the CSI Divisions within this document.

### 1.6.3 Color Boards

Color boards shall be fully edited to include approved changes as a result of the 60 percent submittal. Architectural (AE) design color boards shall be supplied in the format described in government specification Section 09920, CONTRACTOR COLOR BOARDS, paragraphs 2.1 and 3.1. The color boards shall show actual color samples of all proposed exterior and interior finishes. Samples shall be identified by a universal symbol that is used to describe the material on the color boards and drawings for cross reference purposes. A copy of the Interior Finish Schedule and Interior Finish Materials Legend shall accompany the color boards to aid in clearly identifying all finishes. Clarification of finish placement shall be required when more than one color of a single finish is proposed. A minimum of four complete sets shall be supplied to the government.

#### 1.6.3.1 Government Approval

Contractor submitted colorboards shall be reviewed and **APPROVED** by the Government. Government approved AE design colorboards shall become a part of the Contract.

#### 1.6.4 Drawings

Drawings shall be a complete set of architectural drawings as noted in paragraph 1.5.1 of this specification. incorporating all approved comments from the 60 percent submittal. In addition to the drawings and their requirements listed in specification Section 01020, DESIGN AFTER AWARD - 65 PERCENT, the following drawings shall be provided:

##### 1.6.4.1 Enlarged Plans

Enlarged, scaled, expanded floor plans shall be provided for the following rooms or areas:

A. Toilets. Provide expanded plans for all toilet rooms. Minimum scale: 1:20. Plan shall locate and dimension all toilet partition components including partition dividers, doors, and stiles. Plan shall dimensionally locate all wall-mounted accessories to include a symbol/key legend for all accessories.

##### 1.6.4.2 Interior Elevations

Fully dimensioned interior elevations shall be provided of all walls or partial wall areas required to visually and dimensionally locate interior architectural materials, finishes, cabinetry, or equipment incorporating all approved comments from the 60 percent submittal. Interior elevations shall include symbology for required detail cross sections.

##### 1.6.4.3 Schedules and Legends

Provide a fully edited finish schedule in the COE format provided. Provide a fully edited and complete Interior Finish Materials Legend in the COE format provided.

##### 1.6.4.4 Large Scale Details

Large scale details including elevations, cross-sections, and other detail drawings shall be provided as necessary to completely and clearly indicate the design intent and construction materials and installation methods intended. Scales shall be sufficient to allow for full dimensioning, identification of construction materials, and legibility at half-scale drawing size. As a minimum, the following items shall be fully detailed:

- A. Cabinets, Counters, and Casework. Includes countertops, base cabinets, and wall cabinets. Drawings shall include plan views, elevations, typical cross-sections, and installation details.
- B. Interior Signage. Provide scaled elevations of all signage types and sizes to include typical lettering size and location. Provide details regarding installation methods and typical mounting locations.
- C. Other Items. Includes shower stall and shower bench details. Drawings shall include plan views, elevations, typical cross-sections, and installation details.

##### 1.6.4.5 Floor Patterns

Where floor patterns are required or indicated, scaled floor plans of all patterned areas showing the floor patterns shall be provided utilizing a legend and symbols which clearly differentiate colors and provides a

graphic representation of the intended pattern.

#### 1.6.4.6 Interior Signage Plans

All interior signage shall be located on enlarged, scaled floor plans utilizing a system of symbols or legend which cross-references to signage details and the interior signage specification.

#### 1.6.4.7 Generic Furniture/Equipment Plan

Provide a scaled furniture and equipment floor plan which includes, and clearly differentiates between, both contractor and government supplied (not in contract) equipment and furnishings. Government supplied furnishings and equipment shall be shown in typical (estimated) sizes and configurations to illustrate adequate space and circulation space has been provided.

#### 1.6.5 Furniture-Related Interior Design Requirements

The furniture-related interior design requirements shall be provided in a separate 3-ring binder labeled accordingly. This binder(s) shall include:

A. Furniture Floor Plans. These plans shall provide the reviewer and furnishing installers with a coded floor plan and detailed listing of the furniture and furnishings specified for each room. Floor plan scale shall be  $\frac{1}{4}'' = 1'-0''$  where possible and  $\frac{1}{8}'' = 1'-0''$  for areas too large for the plan to fit on the standard module and if data is legible at reduced sizes. Plans shall be show the following:

1. Room name, room number and drawing scale.
2. Furnishings located on the plan shall be indexed by item code, furnishing name, brief description and quantity. This allows reviewer and installation personnel to quickly identify and locate furniture listed.
3. Furnishings item code shall be cross referenced on Furniture Illustration Sheets and Procurement Forms.
4. For series of rooms that are typical (requiring the same number of identical furnishings and finishes, one placement list may be provided for all rooms listed. This list shall be duplicated the required number of time to represent each room. Each page will be numbered in proper sequence.

B. Procurement Sheets. Provide one procurement information sheet for each item specified. As a guideline, procurement information shall include the GSA/Federal Supply contract number, Class number, manufacturer, item, stock number, size, quantity, finish(es), unit cost, total cost, and other detailed and descriptive information as needed. All procuremnt sheets shall be coded and cross-referenced to the floor plans, illustrations, and color boards. Where applicabe cost estimate shall provide:

1. Freight cost broken out as a separate line item.
2. Installation costs broken out as a separate line item.

C. Product Illustrations. Provide one illustration sheet for each

item specified. Illustration shall be a photocopied catalog cut, line drawing, or other picture which clearly illustrates the product to be provided. Illustration sheet shall also include the product item name, manufacturer, and model number. All illustration sheets shall be coded and cross-referenced to the floor plans, procurement forms, and color boards.

D. Color Boards. The color and finish boards shall depict all furniture related materials and finishes. Label and cross-reference samples with the plans and other furniture-related documents. Label the material and finish samples with specific color names. Display samples in a size large enough to indicate true patterns, color and texture. Securely mount samples to the color board modules to withstand long periods of use.

#### 1.6.5.1 Systems (Pre-Wired Workstation) Furniture

All plans and drawings are to be considered part of the contract drawing/document set and shall be labeled as a contract option. These drawings will be incorporated into the contract document set and therefore shall be coordinated with the Design Manager, COE. All electrical and communication elements shall be coordinated with the project design electrical engineer to provide appropriate and adequate electrical power, communications, and data wiring for each workstation. Coordinate thermostat locations and all other wall-mounted items with the appropriate design disciplines to avoid conflict with proposed workstation panel locations. Design submittal requirements shall be the same as for freestanding furniture with regard to illustrations (isometrics of proposed configurations), color board finishes, procurement information, and cost estimate. Utilize the Government supplied, fully edited specification Section 12705, SYSTEMS FURNITURE.

### 1.7 STRUCTURAL

The 100 percent final design submittal shall include all the information presented in the 60 percent submittal, updated to final design status, corrected to reflect any changes made in response to review comments, and shall include the additional requirements specified hereinafter. Any concerns in developing the final design documents shall be resolved prior to starting the final design stage.

#### 1.7.1 DRAWINGS

Final drawings shall be complete, thoroughly checked, and fully coordinated with the other disciplines, specifications and all other construction documents. Previous comments and applicable criteria changes shall have been incorporated into the design. The drawings shall be complete with all plan views, elevations, sections, details, schedules, diagrams, and notes necessary for the construction of the project. For structural steel framing, the drawings shall meet the requirements for design drawings set forth in the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings. All structural steel members and connections shall be fully detailed. Design of structural steel connections shall be the responsibility of the structural design engineer and shall not be delegated to the steel fabricator. For structural concrete, the drawings shall conform to the standards for engineering (design) drawings set forth in the ACI Detailing Manual-1988 (SP-66). Additionally, those items described below which are applicable to the design shall be incorporated into the drawings. Drawings shall be at a

scale appropriate for the design, in no case however, shall plan type drawings be done at a scale smaller than 1:100 or detail type drawings at scale smaller than 1:20.

#### 1.7.1.1 Grid Systems, Dimensions, and Floor Elevations

Each foundation and slab plan, floor framing plan and roof framing plan shall have an alpha-numeric grid system aligned with any columns or pilasters, or with load bearing and non-load bearing walls, as applicable. The same grid system shall be used for all plan views. Each plan view shown shall have all necessary dimensions. On plan views, the dimensions shall define the location of grid lines, offsets, and all structural elements, as well as the overall sizes of the structure. The finish elevation of the ground floor slab shall be indicated as 10000mm, and elevations for all other structural elements shall be numerically referenced to this basic elevation.

#### 1.7.1.2 Plan Sheets

##### a. Foundation and Slab Plans

Foundation and slab plans shall show the size and location of all foundation elements, such as foundation walls and footings. Elevations for footings shall be indicated on the plan. Plans for slabs-on-grade and exterior stoop slabs at building entrances shall show location and type of joints, slab thicknesses and reinforcing, elevation of slab surfaces, and any other design features, such as equipment bases and areas of depressed slab surface, which affect the slab design. Also, indicate that slabs are placed over vapor barrier and capillary water barrier.

##### b. Roof Framing Plans

Roof framing plans shall be provided for all parts of the structure. Plans shall show the size, spacing, and location of all roof framing members, their supporting columns, pilasters or walls, all auxiliary members such as bracing and bridging, orientation and extent of coverage of structural roof deck materials, and the size, location, and framing of all major openings through the roof.

#### 1.7.1.3 Elevation Views, Sections and Details Sheets

Elevation views, sections and details necessary to illustrate fully the design shall be provided. Some requirements peculiar to the various structural materials are described below.

##### a. Concrete

Include elevation views as necessary, plus sections and details to show the outlines of concrete cross-sections, reinforcing bar arrangements, concrete cover for rebar, installation of embedded items, and joint construction. All lap splice and embedment lengths for reinforcing bars shall be clearly indicated on the drawings. A sill detail for each foundation condition at exterior and interior doors shall be provided.

##### b. Masonry

Wall reinforcing shall be located and identified on plans, in section cuts and elevation views. Structural wall elevations shall be included to clarify the construction requirements for masonry reinforcement, especially

the reinforcement around wall openings, piers, bond beams, masonry lintels and at control joints. Details applicable to the project shall be shown on the structural drawings. Listed below are some frequently required masonry details, most of which are shown in Army Corps of Engineers TI 809-04. Additional details as required shall be extracted from other sources and incorporated into the final drawings. All details shall be fully edited to reflect the specific requirements of this project. Supplemental details shall be added as necessary to complete the design.

#### Masonry Details Frequently Used

- Masonry Control Joint (MCJ).
- Control Joint at Bond Beam.
- Bond Beam Corner Reinforcement.
- Seismic Reinforcement Around Wall Openings.
- Wall Reinforcement Details for 1 and/or 2 bar-per-cell stiffeners.
- Doweled or Other Connection of Masonry to Foundation, Floor, Roof or Bond Beam.
- Bond Beam (or Steel) Lintels and Bearing Details
- Lateral Support Detail for Top of Masonry Partition Walls.  
(lateral support locations must be shown on framing plan sheets.)

#### c. Structural Steel, Steel Joists, and Steel Decking

Structural steel connections shall be fully detailed and shown on the drawings. The anchorage of beams, trusses, joists, and steel deck to walls or other bearings, and the extra framing or reinforcement required at deck openings shall also be detailed. Notes, details, or schedules on the drawings shall indicate the steel deck attachment method to be used, and shall give the size and spacing for perimeter, side lap, intermediate supports and end lap attachments. Welded connections shall be detailed using standard weld symbols illustrated in AWS D1.1. All applicable weld sizes, spacing, types, contours and finishes shall be shown.

#### 1.7.1.4 Schedules

##### a. Foundation Schedules

Foundation schedules for footings shall be included, as applicable. The schedule shall include all pertinent information required for the foundation system being used.

##### b. Framing Schedules

For concrete framing, beam and column schedules shall conform to the requirements of the ACI Detailing Manual. For structural steel framing, provide a column schedule complete with column base plates and design loads at splices, if any, and at column bases.

#### 1.7.1.5 Equipment Loads

All equipment loads which exceed 44N and are not supported by concrete slab-on-grade shall be identified on the drawings by showing equipment locations, total weights, and reaction loads at support points.

#### 1.7.1.6 Notes

##### a. Design Notes

Under the heading "Designer's Notes," the structural drawings shall contain notes which begin: "The structural design was prepared using the following data:". The data then listed shall include the structural loading criteria used for design, such as roof and floor live loads, snow load design parameters, wind speed and wind load design parameters, seismic design parameters, allowable soil bearing pressures (as recommended by the Final Foundation Analysis report), foundation design depth, design wind uplift pressures for steel joists and other data pertinent to future alterations. Also, to be listed are the ASTM designations and stress grades of the applicable structural materials: steel, masonry, concrete for each usage, reinforcing bars, welds, and bolts.

b. General Notes

Other notes, which direct the work to be performed, the materials to be used, etc., shall be grouped under the heading of "General Notes." Included in these notes should be a description of the building's structural system, if necessary.

1.7.2 SPECIFICATIONS

Technical specifications for final design shall be prepared in accordance with the instructions provided in Section 01331. The technical specifications shall be complete and fully coordinated with the drawings. All specification indexes shall be completely edited to reflect the paragraphs retained in the body of the specification. All references that have not been used in the body of the specification shall be edited from the technical specification.

1.7.3 DESIGN ANALYSIS NARRATIVE

The final design analysis narrative shall repeat and expand upon the basic information presented in the 60% design analysis narrative, and shall be corrected to reflect revisions made for the final design.

1.7.4 DESIGN ANALYSIS CALCULATIONS

Calculations shall be prepared by an experienced structural engineer and shall include an investigation of loading, (gravity, wind, seismic, etc.) shear, moment, wind uplift, stability and deflection calculations. The computations are to be systematic and accurate. Similar beams, columns, panels, or connections may be grouped by designing the largest member or connection in the group, but every individual slab, beam, column, footing, connection or other structural member or structural consideration indicated by the plans shall be accounted for by pertinent calculations, statement or reasoning, or reference to source. Design formulas shall be written out in symbols the first time each is used, before the numerical values are supplied. All answers shall be identified by dimensional units. Basic assumptions of loads, working stresses, and methods of analysis must appear in the calculations; these assumptions must be applied consistently to a given problem. The calculations shall be presented in a clear and legible form, incorporating a title page, table of contents, and a tabulation showing all design loads and conditions. Pages shall be numbered consecutively and identified in the table of contents. Cross referencing shall be clear. The source of loading conditions, formulas, and references will be identified. Assumptions and conclusions will be explained. Superseded areas of computations must be ruled out. All computations shall be given a complete numerical and theoretical check within the Contractor's office. Calculation sheets shall carry the names

or initials of the developer and the checker, and the dates of calculations and checking. No portion of the design calculations shall be developed and checked by the same individual.

#### 1.7.4.1 Computer Calculation Submittals

All applicable input and output data shall be included in readable printed form as part of the design calculations. Continuous paper such as that used in computer terminals or printers shall be cut into individual pages and shall not be submitted in a continuous roll form. All input and output data shall include a brief synopsis of the computer program(s) stating required input, method of solution, approximations used, codes and specifications used, output generated, extent of previous usage or certification of the program(s), and program author(s). Generalized flow chart(s) may be used to supplement description of solution process, if desired. All computer generated and long-hand calculation sheets shall be identified by sheet number, indexing and cross-referencing. Each member or structure being analyzed shall be identified, dimensioned and shown in a loading diagram. A separate diagram shall be provided for each load case, such as dead plus live, dead plus wind, etc. Input and output values including intermediate values shall clearly be identified if such values are necessary for evaluation of the submittal.

### 1.8 MECHANICAL

The 100 percent final design submittal shall include all the information presented in the 60 percent submittal, updated to final design status, corrected to reflect any changes made in response to review comments, and shall include the additional requirements specified hereinafter. Any concerns in developing the final design documents shall be resolved prior to starting the final design stage.

#### 1.8.1 DESIGN ANALYSIS NARRATIVE

The Final Design Analysis Narrative shall include the information presented in the 60 percent submittal. The information shall be corrected to reflect changes in content made in response to review comments, and shall be expanded to reflect the completed design.

#### 1.8.2 CALCULATIONS

The Final Design Analysis calculations shall include all the information presented in the 60 percent submittal, shall be corrected to reflect changes in content made in response to review comments, and shall be expanded to reflect the completed design. In addition, the following new calculations shall be provided:

##### 1.8.2.1 Pump Selections

Include pump flow calculations as specified in Section 01016, MECHANICAL REQUIREMENTS and catalog selection data indicating dimensions, connection sizes, rpm, horsepower, and efficiency.

##### 1.8.2.2 Domestic Hot Water Recirculation Pump Selection

Include pump flow calculations as specified in Section 01016, MECHANICAL REQUIREMENTS and catalog selection data indicating dimensions, connection sizes, rpm, horsepower, and efficiency.

#### 1.8.2.3 External Pressure Drop Calculations

External pressure drop calculations for all fans as specified in Section 01016, MECHANICAL REQUIREMENTS shall be provided.

#### 1.8.2.4 Hydronic Calculations

Pipe sizing and pump head calculations for the chilled & heating hot water, plumbing, gas piping systems as specified in Section 01016, MECHANICAL REQUIREMENTS shall be provided.

#### 1.8.2.5 Expansion Tank Sizing

Chilled & heating hot water expansion tank sizing shall be provided.

#### 1.8.2.6 Electrical Load Summary

A summary of all mechanical equipment and the associated electrical load requirements shall be provided.

#### 1.8.2.7 Control Valve CV

Provide Control Valve CV calculations.

#### 1.8.3 CONSTRUCTION DRAWINGS

The drawings shall be fully coordinated with the design analysis and specifications. Provide sufficient plans, piping diagrams and isometrics, sections, air and water flow diagrams, details, schedules, and control diagrams/sequences of operation etc. shall be provided as necessary to define the required design intent and requirements. The designer shall show on the construction drawings all items which are referred to with phrases such as "as shown", "as indicated", "as detailed", etc within the UFGS Specifications. The construction drawings shall show, to scale, the actual equipment to be installed and all required clearances required for operation, routine maintenance, and replacement of minor and major components. The drawings shall not show any piping, ductwork or other mechanical equipment to be exposed in finished spaces except where approved by the government. All exposed items shall be called out to the government for approval before proceeding. Access panels required for concealed items shall be shown on the construction drawings. The design and installation shall be fully coordinated with all other trades involved in the design and construction of the facility. Special care shall be given to National Electric Code requirements for clearance in front of and above electrical equipment. The construction drawing shall be produced to incorporate the requirements below into all drawings. Furthermore, the requirements below shall be repeated in the form of general notes on every mechanical (both HVAC and plumbing) construction drawing that shows a plan view. General notes shall include any mechanical general installation notes that may be required to clarify the construction intent that may not be readily apparent in the specifications or on the drawings. General notes may be provided on a separate sheet if space does not exist on the plan sheets. Sheet reference number sequencing shall be in accordance with the A/E/C CADD Standards Manual, ERDC/ITL TR-01-6. Submittal drawings shall include, but not limited to, the following:

##### 1.8.3.1 Drawing Clarity

All drawings specified below, when reproduced at half scale, shall be clear

and easily readable as determined by the Contracting Officer's Representative (COR).

#### 1.8.3.2 Drawing Coordination

Show on all mechanical drawings specified below, all items of mechanical equipment and systems, to determine proper space allocation within the limits of the architectural, structural and electrical layout requirements.

Plans, elevations, and sections shall be developed sufficiently to insure that major equipment items, piping, and ductwork cause no interference with architectural members, structural members, electrical equipment, etc.

#### 1.8.3.3 HVAC Controls Legend

This sheet shall include all control abbreviations and symbols that will be used on the drawings and on the Final Control Drawings. Control abbreviations and symbols shall be as specified in Army Technical Instructions, TI 810-11, Heating, Ventilating and Air Conditioning Control Systems for all abbreviations and symbols used.

#### 1.8.3.4 General HVAC Control Drawing Requirements

Control schematics showing all control system interface points and detailed sequence of operation shall be provided for all mechanical equipment and systems. Control drawings shall be as specified in Army Technical Instructions, TI 810-11, Heating, Ventilating and Air Conditioning Control Systems and as specified in section 01016, MECHANICAL REQUIREMENTS. The drawings shall include at a minimum each of the components specified below for each of the systems specified below. In addition to the components specified below, damper and control valve schedules shall also be provided. Standard Control Drawings based on the requirements of TI 810-11 are available for each system type.

#### 1.8.3.5 Control Diagrams

Control Diagrams shall be provided for each system or item of equipment. Systems diagrams shall include every major component installed in or connected to the system, and only one system shall be shown on each diagram. Control Diagrams shall schematically show all sensors, controllers, actuators, indicators, and operator interface devices that are required for the complete automatic control and monitoring of the system. All sensing devices utilized in the control or instrumentation of the system, and all actuating devices shall be shown in their correct mechanical location and functionally interconnected to the other control devices which comprise the control loop. All controlling devices shall be shown with all functional interconnections to inputs and outputs. Each sensing, controlling, actuating, and indicating device shall have its own unique control loop tag identifier. Communication linkages required to complete the entire intended interface between operators and the control system shall be shown schematically. This includes interconnections between local temperature control panels and the base EMCS. All associated thermometers and pressure gauges, located in their correct mechanical locations, shall also be shown on the diagrams. See furnished Example HVAC Control Drawings for the required level of detail and formatting.

#### 1.8.3.6 Sequence of Operations

Sequence of Operations shall be provided for each item of equipment or system and shall fully describe the intended operation of the equipment or

system in all different operating modes. As identified on the furnished Example Control Drawings, each Sequence shall be broken down by individual control loops and shall include descriptions of both normal operating modes (running, shutdown, standby, etc.) and abnormal, emergency or safety related modes. Sequences shall include a description of all indication instrumentation, alarm conditions, and automatic actions to be taken upon occurrence of alarm conditions. Each device referenced in the sequence shall be referred to by its unique tag identifier, with each component designator shown in parenthesis. Design setpoints shall be specified for each control loop and indicated as being adjustable. See furnished Example HVAC Control Drawings for the required level of detail and formatting.

#### 1.8.3.7 Control Points Lists

Control points lists, identifying each temperature control system input and output, shall be developed for each temperature control panel.

#### 1.8.3.8 Functional Performance Checklists

The designer shall analyze every component of each system and write Functional Performance Checklists to compliment each Sequence of Operation.

The Functional Performance Test Checklists shall be explicit and written to ensure that all the requirements of the Sequence of Control on the project drawings can be accomplished.

#### 1.8.3.9 Hot Water System

Provide a hot water flow diagrams showing the boiler modules, pumps, and all connected heating equipment as the system control schematic. All thermometers, pressure gauges, isolation and control valves, bypass piping, etc. shall be shown on the flow diagram. In addition, provide a sequence of operation.

#### 1.8.3.10 Chilled Water System

Provide a chilled water flow diagrams showing the chiller, fluid coolers, pumps, and all connected cooling equipment as the system control schematic.

All thermometers, pressure gauges, isolation and control valves, bypass piping, etc. shall be shown on the flow diagrams. In addition to the chilled water pumping system control schematic, provide a sequence of operation. Include all items of equipment that are interlocked to each system.

#### 1.8.3.11 Air Handling Systems

For each air handling system, including outside air makeup system, provide a control schematic and a sequence of operation. Include all items of equipment that are interlocked to each system.

#### 1.8.3.12 Misc Systems

These sheets shall include all miscellaneous equipment items such as supply/exhaust fans, unit heaters, radiant floor heating, infra-red heaters, controls, air compressors, etc. that are not interlocked to the main HW, CW or air handling unit systems. Provide control schematic and sequence of control for each item of equipment on the same sheet.

#### 1.8.4 SPECIFICATIONS

The submitted 60 percent technical guide specifications shall be updated, completely edited, and fully coordinated with the drawings to accurately and clearly identify the final product and installation requirements for the facility. Technical specifications shall be Unified Facilities Guide Specifications (UFGS), which shall be completely edited and fully coordinated with the drawings to accurately and clearly identify the product and installation requirements for the facility as specified in Section 15000, DIVISION 15: MECHANICAL - OUTLINE SPECIFICATIONS. The UFGS specifications define the minimum requirements for items of equipment, materials, installation, training, operating and maintenance instructions, O&M manuals and testing that shall be provided for the facility. All UFGS specification indexes shall be completely edited to reflect the paragraphs retained in the body of the technical specification. All references that have not been used in the body of the technical specification shall be edited from the UFGS specification. Technical specifications shall be coordinated with the plans and include all items contained within the project. Provide special sections to cover those subjects for which no UFGS guide specification is available. Specific items of equipment identified in the UFGS specifications but not required for the facility shall be edited out. All edited UFGS guide specifications, to be provided, shall be in edited form showing all text to be deleted and added. Government conformance review is required for any specification addition or deletion.

## 1.9 ELECTRICAL

### 1.9.1 Drawings

Drawing scale shall match architectural drawing requirements.

#### 1.9.1.1 Interior Drawings

Drawings shall be complete and accurate in every detail and shall include arrangements and types of light fixtures, receptacles, switching, location of special features, necessary details, including legends, fixture schedule, panel schedules, one-line diagrams, layout or functional diagrams for each of the various systems, riser diagrams if applicable, estimated maximum demand for each panel and for entire building and any other relative information which will help clear up any and all questionable items on the plans or in the specifications toward the development of a set of plans which will be clear, concise and correct. Additional drawing requirements for specific equipment or systems have been included in subsequent paragraphs pertaining to the equipment or systems.

#### 1.9.1.2 Floor Plans

All rooms must be identified by name and number. Plans must be legible. Plans shall be developed using the same scale and areas as the architectural floor plans. Separate floor plans must be provided for lighting, power, communications, and fire detection.

#### 1.9.1.3 Diagrams

The power one-line diagram shall be on a dedicated sheet. The diagram should show ratings of major equipment including short circuit ratings. Power, communications diagrams, fire detection and telephone diagrams should be on separate sheets also.

#### 1.9.1.4 Schedules

Provide panelboard and lighting fixture schedules. Panelboard schedules shall include the designation, location, mounting (flush or surface), number of phases and wires, voltage, ampacity and total connected and demand load. Indicate the trip rating, frame size, interrupting rating and number of poles for each circuit breaker in the panelboards. List the circuit number, circuit description and load for each branch circuit.

#### 1.9.1.5 Exterior Drawings

Drawings shall be complete and accurate in all details and shall include the routing of all feeder and branch circuits.

#### 1.9.2 Specifications

All specifications shall be completely edited and fully coordinated with the drawings to accurately and clearly identify the product, installation requirements, and testing methods for this facility.

#### 1.9.3 Design Analysis Narrative

The text of the preliminary design analysis should be expanded to reflect the completed design. Calculations used to develop the design should be included. The document in its final form should conform in all applicable respects to the requirements of Section 01007 ELECTRICAL DESIGN REQUIREMENTS.

#### 1.9.4 Design Analysis Calculations

Backup data shall be furnished to support basic design decisions related to sizing of major equipment and materials, selection of economic alternatives, performance of specific systems or equipment. Calculations may be performed by manual or computerized procedures. Use of standardized charts, curves, tables, graphs will generally be acceptable for portions of required calculations or in lieu of specific calculation procedures. Such data must be from a recognized source which is identified in the design analysis. If possible, a copy of applicable sheets or pages should be included with the calculations. For given equipment, the calculations must conform to requirements identified under subsequent paragraphs herein pertaining to the equipment.

##### 1.9.4.1 Service

Sizing of building service.

##### 1.9.4.2 Transformers

Sizing of all transformers. (Generally for dry type transformers, 1 or 2 samples of detailed calculations to identify the method are sufficient, if input data for remaining units can be derived from panel or feeder sizing data.)

##### 1.9.4.3 Feeders

Sizing of feeders (One detailed sample calculation is sufficient to establish the procedure, remaining data can be in schedules, tables, etc.).

##### 1.9.4.4 Panelboards

Sizing and loading of panelboards and distribution equipment.

#### 1.9.4.5 Voltage drop determination

Provide voltage drop calculations in accordance with IEEE 241 to demonstrate that the voltage drop requirements of NFPA 70 are satisfied.

#### 1.9.4.6 Illumination calculations

Data should identify target and calculated illumination levels for all rooms and areas. Calculations should be adjusted to compensate for special applications -- irregularly shaped rooms, open sides, ceiling obstructions (beams, ductwork), corridors, etc. If the lumen method is used for corridor calculations, the calculations should be performed using a module in which the length doesn't exceed 3 times the width (2:1 ratio preferred).

#### 1.9.4.7 Short Circuit Evaluation

Calculate the fault current in accordance with IEEE 242 for each node in the electrical distribution system.

#### 1.9.4.8 Protective Coordination Analysis

A protective coordination study (if required) shall be performed to show that the power system is selectively coordinated and is fully coordinated with the upstream overcurrent devices. The study shall include the interior electrical distribution system and primary distribution system back to the existing primary line. The protective coordination / short circuit study shall be complete and approved by the government before any changes are made to the existing equipment.

#### 1.9.4.9 Specialized Applications

Additional engineering backup should be included to address special requirements such as accommodation of nonlinear loads, harmonics analysis, energy studies, etc.

### 1.10 FIRE PROTECTION

#### 1.10.1 DRAWINGS

Design will be an extension of the 60% submittal, incorporating all comments thereto and any revised criteria, all as specifically directed by the District Office. All conflicts, lack of specific criteria, and/or direction, inconsistencies, ambiguities, and lack of thorough understanding of the nature and scope of work shall be resolved prior to starting final design work. The fire protection plans shall show the following: entire sprinkler system; fire detection system, to include control panels, remote annunciators, alarm notification devices, and each initiating device; fire walls; fire partitions; building separations; other fire protection features.

#### 1.10.2 DESIGN ANALYSIS

The final design analysis will be an extension of the 60% design analysis and shall be complete for every item covered in the design and will include, but not be limited to, the following:

- a. List of design criteria.

- b. Design conditions.
- c. Design calculations.
- d. Complete description of system alarm zones.
- e. Complete description of system sprinkler system.
- f. Complete description of the building fire protection features.
- g. Other pertinent information of value for future use in construction contract administration, substantiation of design methods, or permanent record shall be included.

1.10.3 TECHNICAL GUIDE SPECIFICATIONS

The following CEGS guide specifications shall be completely edited and fully coordinated with the drawings to accurately and clearly identify the product and installation requirements for the facility:

13930	Wet-Pipe Sprinkler System, Fire Protection
13851	Fire Detection System and Alarm System, Addressable

All items identified in the specifications not required shall be marked for deletion in accordance with the requirements of Section 01332 SUBMITTALS DURING DESIGN. Those items of equipment, materials, or installation requirements that are required are not permitted to be modified or changed from that presently shown. Government approval is required for the final submittal of these guide specs.

1.11 ENVIRONMENTAL PROTECTION, COMPLIANCE, AND PERMITS

All environmental requirements that have been identified during the design process shall be include in the 100% Environmental Protection, Compliance, and Permits Design Analysis Chapter, the 100% Environmental Protection Plan, and/or Appendix to the Environmental Protection Plan.

1.11.1 Design Analysis Chapter

The Contractor shall update the chapter in the Design Analysis entitled: "ENVIRONMENTAL PROTECTION, COMPLIANCE, AND PERMITS". The updated chapter shall include additional summaries of environmental coordination, compliance, approvals, permits, and etc. required for the project. The Contractor shall include additional documentations of the coordination, discussions, phone conversation records, and/or letters required to assure that the project is in full compliance with all Federal, State, Regional, and local environmental laws and regulations. The Contractor shall included an updated list of environmental permits, approvals, notifications, etc. that are required for the project.

1.11.2 Environmental Protection Plan

The Contractor shall update the 60% Draft Environmental Protection Plan to include all additional environmental requirements identified. The updated plan shall be submit for final review and acceptance.

1.11.3 Appendix to the Environmental Protection Plan

As an Appendix to the Final Environmental Protection Plan, the Contractor shall submit copies of the completed permit applications and associated documents, notices, reviews, and/or approvals that are required for the project. Copies of all permits and/or approvals required for the project shall be included along with any additional requirements and/or conditions of the permits which are required during and/or at completion of construction.

1.11.4 NPDES Storm Water Permit

If the project requires coverage under the General NPDES Permit for Storm Water Discharges from a Construction Site, the Contractor shall submit the following.

1.11.4.1 Notice of Intent (NOI)

Parts I and II of the Contractor's NOI shall be completed.

1.11.4.2 Notice of Termination (NOT)

Parts II and III of the NOT shall be completed.

1.11.4.3 Storm Water Pollution Prevention Plan (SWPPP)

Complete the Storm Water Pollution Prevention Plan. A SWPPP outline is available at ftp:\\ftp.nwo.usace.arm.mil/pub/ED/SWPPP/ file name: SWPPP.DOC or SWPPP.PDF.

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --

## SECTION 01022

## FIRE PROTECTION REQUIREMENTS

## PART 1 FIRE PROTECTION REQUIREMENTS

## 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 basic designation only.

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 13 (1999) Installation of Sprinkler Systems

## 1.2 GENERAL PARAMETERS

All military construction must comply with the requirements of UFC 3-600-01. This states that the type of construction and building area requirements are to be determined from the International Building Code (IBC). All other requirements for separation, exiting, fire suppression, detection and alarms are to be determined from NFPA codes.

Fire protection shall be based on sound fire protection engineering principles that gives safeguards against loss of life and property by fire, consistent with the mission, risk involved, and economical utilization.

All applicable requirements of the aforementioned codes shall be incorporated into the design. Life Safety Code, NFPA 101 relative to this design shall give special attention to the application of fire codes as they relate to Life Safety. Features of fire protection based on the following shall be included in the design: automatic operating devices; exiting for inhabitants and the protection of egress components; personnel safety in hazardous areas; appropriate ratings of partitions, doors and windows; travel distances; common paths of travel; occupancy types; hazard of occupancies and their contents; isolation from the remainder of the facility; etc.

## 1.2.1 Types of Occupancies and List of Hazardous Areas/Essential Equipment

## 1.2.1.1 Occupancy Classification

## 1. Refueler maintenance.

The Refueler maintenance building is an Industrial Occupancy in accordance with NFPA 101. According to the International Building Code (IBC), the building shall be classified as a "Group H-3" occupancy per paragraph 307.5, Group H-3 structures.

## 2. POL Operations Center.

The POL building is a Business Occupancy in accordance with NFPA 101. According to the International Building Code (IBC), the building shall be classified as a "Group B" occupancy per paragraph 304.1, Business Group B.

#### 1.2.1.2 Classification of Hazard of Contents

The classification of hazard of contents shall be determined by each portion of the building.

#### 1.2.2 Separation of Structure

##### 1.2.2.1 Exposure Classification

The building construction shall be a one-story structure. The types of non-combustible roof construction options available for each facility shall be determined by the Proposer, in accordance with the requirements contained within the RFP.

#### 1.2.3 Fire Fighting Support

The main fire suppression for the Refueler Maintenance Facility and POL Operations Center shall be supplied by an automatic wet pipe sprinkler system. This fire protection and suppression system shall be tied into the building's fire detection and alarm system. The building shall be provided with fire extinguisher cabinets. The fire extinguisher cabinets shall be of the fully recessed type in all finished areas.

A fire alarm system in accordance with NFPA-72 shall be provided that covers the various parts of the building, monitoring of the sprinkler system, air handling units, etc..

See subsequent paragraphs of this Fire Protection section for additional information regarding fire suppression, detection, and other aspects of fire fighting support. Fire extinguishers are to be Contractor furnished/Contractor installed.

### 1.3 FUNCTIONAL AND TECHNICAL REQUIREMENTS

#### 1.3.1 Construction for Fire Resistances of the Building Including Roofs, Walls, and Doors.

##### 1.3.1.1 Building Construction Type

The building structures shall be a minimum Type II-B in accordance with the IBC. However, the offeror's design agent is responsible for verifying the appropriate construction type for each facility, or portion thereof.

##### 1.3.1.2 Exterior Walls

Exterior walls of the facilities shall not be rated as long as minimum distances from other buildings are maintained.

##### 1.3.1.3 Roof

The building roof covering shall be Factory Mutual Approved or classified by Underwriter's Laboratory as Class A, roof system.

##### 1.3.1.4 Interior Walls

Fire separation of various occupancies shall be provided per NFPA 101. All penetrations in fire rated walls (conduits, pipes, cable trays...etc.) shall be firestopped according to their respective wall/floor/ceiling

rating at each penetration.

### 1.3.2 Type of Occupancies, Occupant Loads, Exits, and Travel Distances to Exits

#### 1.3.2.1 Occupant Load

For purposes of determining required exits, the occupant load shall be based upon the actual maximum number of persons intended to occupy the space but not less than that required by NFPA 101.

#### 1.3.2.2 Means of Egress

Not less than two exits shall be accessible from every part of the facility.

#### 1.3.2.3 Travel Distance to Exits

Allowable travel distance limits to exits shall be per NFPA 101, Chapter 30.

### 1.3.3 Resistance to Interior Finishes and Materials to Flame Spread and Smoke Development

#### 1.3.3.1 Interior Finishes

Interior finish materials on walls, ceilings, and partitions in all exits shall be Class A as defined in the International Building Code (IBC) and UFC 3-600-01. All other areas shall have Class A or B interior finish materials for walls, ceilings, and furnishings. Smoke Developed Ratings shall not exceed 50 for Class A materials and 100 for Class B materials when tested in accordance with ASTM E-84.

#### 1.3.3.2 Cellular Plastics

Cellular Plastics shall not be used as interior wall and ceiling materials per UFC 3-600-01.

#### 1.3.3.3 Floor Finishes

Floor finishes shall be Class I or Class II. Carpet and other floor finishes shall have passed the acceptable criteria of American Society for Testing and Materials (ASTM) standard 84 or equivalent.

### 1.3.4 Fire Extinguisher Cabinets

Fire extinguisher cabinets shall be provided per NFPA 10 with a travel distance between fire extinguisher cabinets not to exceed 75 feet. Fire extinguisher cabinets shall be fully-recessed in finished areas, such as administrative, corridors, etc. Ten pound ABC rated Fire extinguishers shall be supplied as part of this contract.

### 1.3.5 Not Used

### 1.3.6 Sprinkler Systems

Wet pipe sprinkler system shall be provided in all areas of the Refueler Maintenance Facility and POL Operations Center buildings. The sprinkler system shall provide fire sprinkler protection for the entire building. The wet pipe sprinkler system shall be provided for 100% coverage. Except as modified herein, the system shall be designed and installed in

accordance with NFPA 13 and UFC 3-600-01. Where any conflicts exist between UFC 3-600-01 and other criteria, the requirement in UFC 3-600-01 shall be met. Pipe sizes shall be shown on drawings and shall be determined by hydraulic calculation. The design of the sprinkler system shall be based on hydraulic calculations, and the other provisions specified herein. The Fire Protection Engineer shall fully investigate the water supply, including all modifications made to the distribution system as part of this contract to determine the requirements for fire protection system as required by UFC 3-600-01.

#### 1.3.7 Fire Protection Engineer.

The sprinkler and fire alarm system shall be designed by a qualified fire protection engineer as defined in UFC 3-600-01. All work shall be performed under the supervision of and certified by the Fire Protection Specialist. The Fire Protection Specialist shall be an individual who is a registered professional engineer and a Full Member of the Society of Fire Protection Engineers. The Fire Protection Specialist shall be regularly engaged in the design and installation of the type and complexity of system specified in the Contract documents, and shall have served in a similar capacity for at least three systems that have performed in the manner intended for a period of not less than 6 months.

#### 1.3.8 Hazard Classifications.

The area hazard classifications shall be as classified in accordance with NFPA 13.

#### 1.3.9 Not Used

#### 1.3.10 Hydraulic Calculations.

Hydraulic calculations shall be in accordance with the Area/Density Method of NFPA 13 except that calculations shall be performed by computer using software intended specifically for fire protection system design using the design data shown on the drawings. Hydraulic calculations shall be based upon the Hazen-Williams formula with a "C" value of 120 for steel piping, 150 for copper tubing, 140 for new cement-lined ductile-iron piping, and 100 for existing underground piping. Software that uses k-factors for typical branch lines is not acceptable. Calculations shall be based on the water supply data verified by the designer. Calculations shall substantiate that the design area used in the calculations is the most demanding hydraulically. Water supply curves and system requirements shall be plotted on semi-logarithmic graph paper so as to present a summary of the complete hydraulic calculation. A summary sheet listing sprinklers in the design area and their respective hydraulic reference points, elevations, actual discharge pressures and actual flows shall be provided. Elevations of hydraulic reference points (nodes) shall be indicated. Documentation shall identify each pipe individually and the nodes connected thereto. The diameter, length, flow, velocity, friction loss, number and type fittings, total friction loss in the pipe, equivalent pipe length and Hazen-Williams coefficient shall be indicated for each pipe. For gridded systems, calculations shall show peaking of demand area friction loss to verify that the hydraulically most demanding area is being used. Also for gridded systems, a flow diagram indicating the quantity and direction of flows shall be included. The minimum pipe size for branch lines in gridded systems shall be 32 mm . Water velocity in the piping shall not exceed 6 m/s . A drawing showing hydraulic reference points (nodes) and pipe designations used in the calculations shall be included and shall be

independent of shop drawings.

#### 1.3.11 Hose Demand

An allowance for exterior hose streams of 1892 L/min shall be added to the sprinkler system demand at the point of connection to the existing system. An allowance for interior hose stations of 1892 L/min shall also be added to the sprinkler system demand.

#### 1.3.12 Fire Flows Data.

The fire protection engineer shall perform fire flow test to determine the actual static pressure, residual pressure and flow at the finished site. The actual system installed shall be based on these final results for the finished site. Fire flows data for the CDC site is as follows:

##### 1.3.12.1 Sprinkler Spacing

Sprinklers shall be uniformly spaced on branch lines. Maximum spacing per sprinkler shall not exceed limits specified in NFPA 13 for each individual hazard occupancy.

#### 1.3.13 Fire Department Connections and Fire Hydrants

Fire Department connections for the sprinkler system(s) shall be provided with suitable all weather access for pumper apparatus within 150 feet, reference UFC 3-600-01. A minimum of one fire hydrant shall be located within 150 feet of the fire department connections, reference UFC 3-600-01.

#### 1.3.14 HVAC System.

All HVAC systems shall be designed in accordance with NFPA 90A for fire dampers, smoke dampers and fan shutdown. The designer shall show on the construction drawings all fire or smoke dampers required by NFPA.

#### 1.3.15 Fire Alarm and Detection System

The system shall be designed in accordance with UFC 3-600-01, NFPA 72 and NFPA 101. Supervisory initiating devices shall be provided and designed in accordance with NFPA 13 and 72. Placement of audio/visual devices shall comply with the Americans with Disabilities Act (ADA) and NFPA 72. Use the most stringent requirements from ADA or NFPA 72 where conflicts occur. Outside electric bell for sprinkler system(s) shall also be provided with a visual strobe. The facility shall be provided with a main control panel. A local annunciator is required in the vestibule of the POL Operations Center. Fire alarm system shall be addressable to each device. The system shall use Style 6, SLC and Style Z NAC. Alarms shall be transmitted back to the Post Fire Station via a Mononco D-700 Transciever.

##### 1.3.15.1 Main Control Panel

The Main Fire Alarm control panel shall be located in each building electric room or mech room if no dedicated electric room provided. Devices installed in the service station shall be an extension of POL fire alarm system. Devices at the service station shall be on a seperate zone. The panel shall shut down the entire HVAC system upon activiaton. Fire alarm system alarms, supervisory signals and trouble conditions shall be as follows:

- a. Alarms
  - 1. Manual Pull Station
  - 2. Duct Smoke Detector
  - 3. Waterflow Indicator
  - 4. Smoke Detector
- b. Supervisory Signals
  - 1. Valve Supervisory Switches
  - 2. Control Components
  - 3. Transceiver Door Tamper Switch
- c. Trouble Conditions
  - 1. Low Battery Voltage
  - 2. Circuit Fault
  - 3. Supervised Component Failure
  - 4. Power Failure

#### 1.3.15.2 Annunciator Panel

A flush mounted annunciator panel shall be located in the vestibule of the POL building only (Refueler maintenance has no annunciator requirement). The panel shall provide an appropriately sized floor plan of the building with names and room numbers indicated. The building will be separated into zones. Each zone shall have two red alarm lights. One light will be labeled initiating device and the other labeled water flow. A yellow trouble and blue supervisory light shall be included for each zone.

#### 1.3.15.3 Monaco Transceiver

A Monaco D-700 transceiver shall be provided each for POL and Refueler maintenance to transmit information to the base fire department. The transmitter shall be sized for the following zones:

- a. Alarm by initiating device
- b. Supervisory Alarm
- c. Trouble Alarm
- d. Sprinkler Water Flow
- e. Alarm Panel and Transceiver Door Tamper Switches
- f. Four Spare Zones

#### 1.3.15.4 NFPA 13 and NFPA 72 Requirements

Provide control modules, smoke detectors, OS&Y tamper switches and water flow switches as required by NFPA 13 and NFPA 72. The requirements for smoke and heat detectors shall be as required by NFPA 101. All signaling line circuits shall be Style 6.

#### 1.3.15.5 Other Requirements

- A. Provide duct detectors, manual pull stations, flow switches, tamper switches, notifications appliances, etc. The notification appliances shall be with flashing strobe.
- B. Provide programable device and required cables for connecting to

the system.

C. Provide all software and a backup copy of all programming code for the system.

1.3.15.6 Alarm Verification

The system shall be provided with alarm verification features. The alarm verification features shall reduce false alarms due to transient conditions. The alarm/activation delay shall be adjustable from 0 to 60 seconds.

1.3.15.7 Indicating Devices

Evacuation indicating signalling devices shall be provided and designed in accordance with NFPA 101. Indicating devices shall be Style Z as defined by NFPA 72. Evacuation alarms shall be activated by any action described above under the alarm heading. Indicating devices shall be chimes with strobe lights.

1.3.15.8 System Design

The contractor shall edit and provide UFGS guide specifications for SECTION 13851, FIRE DETECTION AND ALARM SYSTEM, ADDRESSABLE. The fire detection system shall be designed in accordance with the criteria specified in paragraph SYSTEM DESIGN of SECTION 13851. All requirements contained in SECTION 01017 ELECTRICAL REQUIREMENTS & Space Data Sheets of the RFP document must be incorporated into the edited specifications.

1.4 DESIGN OBJECTIVES AND PROVISIONS

1.4.1 Zoning and Treatment of Each Potential Hazard

1.4.1.1 Fire Alarms and Extinguishing Systems

The facilities shall be provided with a fire suppression system and a detection system as indicated previously.

1.4.1.2 Egress Locations

Egress locations shall be marked with exit signs per Section 01017. (LSC).

1.4.2 Required Fire Exits

Required fire exits from the building shall lead to a public way or to a clear safe area at a minimum distance of 75 feet from the building.

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --

## SECTION 01100

## GENERAL

## PART 1 GENERAL

## 1.1 INQUIRIES

Pursuant to SECTION 00100 paragraph titled "Instructions to Offerors--Competitive Acquisition", any inquiries regarding this Invitation, before bids are opened, should be addressed to the District Engineer, Kansas City District, Corps of Engineers, 700 Federal Building, Kansas City, Missouri 64106, ATTN: Mr. Edgar Ray. Inquiries for which oral explanation or advice on the plans and specifications will suffice may be referred to Mr. Ray by calling Area Code 816-983-3264. Telephone calls concerning the mailing of plans and specifications should be made to Contracting Division at Area Code 816-983-3975. Collect telephone calls will not be accepted. (KCDO APR 84)

## 1.2 SUPERINTENDENCE OF SUBCONTRACTORS

(a) The Contractor shall be required to furnish the following:

(1) If more than 50% and less than 70% of the value of the contract work is subcontracted, one superintendent shall be provided at the site and on the Contractor's payroll to be responsible for coordinating, directing, inspecting and expediting the subcontract work.

(2) If 70% or more of the value of the work is subcontracted, the Contractor shall be required to furnish two such superintendents to be responsible for coordinating, directing, inspecting and expediting the subcontract work.

(b) If the Contracting Officer, at any time after 50% of the subcontracted work has been completed, finds that satisfactory progress is being made, he may waive all or part of the above requirement for additional superintendence subject to the right of the Contracting Officer to reinstate such requirement if at any time during the progress of the remaining work he finds that satisfactory progress is not being made.

## 1.3 IDENTIFICATION OF EMPLOYEES

The Contractor shall be responsible for furnishing to each employee and for requiring each employee engaged on the work to display identification as may be approved and directed by the Contracting Office. All prescribed identification shall immediately be delivered to the Contracting Officer, for cancellation upon the release of any employee. When required by the Contracting Officer the Contractor shall obtain and submit fingerprints of all persons employed or to be employed on the project.

## 1.4 APPLICATION OF WAGE RATES

The inclusion of the Davis-Bacon Act General Wage Decision or the Service Contract Act Wage Determination in the solicitation is a statutory requirement. It is not a representation by the U.S. Army Corps of Engineers that any specific work task can be performed by any specific trade. Which work tasks can be performed by what trades depends on and is determined by the prevailing area practice for the local area where the

contract is being performed. It is the sole responsibility of the offeror to determine and comply with the prevailing area practice. Inquiries regarding a prevailing area practice should be directed to the Corps of Engineers, Contractor Industrial Relations Specialist (telephone number 816-983-3723) or to the Department of Labor Regional Wage and Hour Division.

Application of wage rates and fringe benefits: For the application of the wage rates and fringe benefits contained in the Decisions of the Secretary of Labor, attached to and a part of this contract, all work required within 5 feet outside building lines shall be considered Building (or Residential) Construction.

Highway Construction rates apply to the construction, alteration or repair of roads, streets, highways, runways, taxiways, alleys, trails, paths, parking areas, and other similar projects.

All other construction not defined herein as Building (or Residential) Construction or Highway Construction shall be considered Heavy Construction.

1.5 PAYMENTS TO SUBCONTRACTORS

The Contractor's attention is directed to CONTRACT CLAUSE titled "Payment Under Fixed-Price Construction Contracts." In addition to the requirements set forth in the referenced paragraph, the Government will reimburse the Contractor, upon request, for amount of premiums paid by the subcontractors for performance and payment bonds (including coinsurance and reinsurance agreements, when applicable) after the Contractor furnishes evidence of full payment to the surety.

1.6 PAYMENTS TO CONTRACTOR (KCD MAY 90 - FORMERLY FAR 52.2/9101(a))

The following is an example of a Contractor's release of claims clauses required to comply with the provisions of paragraph (h) of the CONTRACT CLAUSE titled "Payments Under Fixed-Price Construction Contracts":

RELEASE OF CLAIMS

The undersigned Contractor under contract dated \_\_\_\_\_, 2000, between the United States of America and said Contractor for the \_\_\_\_\_ located at \_\_\_\_\_, in accordance with paragraph (h) of the CONTRACT CLAUSE titled "Payments Under Fixed-Price Construction Contracts" of said contract, hereby releases the United States, its officers, agents, and employees from any and all claims arising under or by virtue of said contract or any modification or change thereof except with respect to those claims, if any, listed below:

(Here itemize claims and amounts due.)

1.7 PARTNERING

The Government intends to encourage the foundation of a cohesive partnership with the Contractor and its subcontractor. This partnership will be structured to draw on the strengths of each organization to identify and achieve mutual goals with the intent to complete the Contract within budget, on schedule and in accordance with plans and specifications. This partnership will be bilateral in makeup, and participation will be totally voluntary. Any cost associated with implementing this partnership will be agreed to by the Contractor and the

Government, and will be shared equally with no change in Contract price. To implement this partnership initiative, it is anticipated that thirty (30) days after Notice to Proceed, a team building workshop will be conducted. Follow-up workshops will be held periodically throughout the duration of the Contract as agreed to by the Contractor and the Government.

#### 1.8 PROSPECTIVE CONTRACTOR RESPONSIBILITY

Each bidder shall furnish, within 3 calendar days after receipt of request therefor, data which will show the bidder's ability to perform the work or services required by this Invitation for Bids. Such data shall include as a minimum: Bank certification of financial capability, or a financial statement not over 60 days old, which will be treated as confidential (if over 60 days old, a certificate shall be attached thereto stating that the financial condition is substantially the same or, if not the same, the changes that have taken place); names of commercial and financial reporting agencies from whom credit reports may be obtained; trade creditors; name and address of bonding company; business and construction experience; past record of performance of Government contracts; and construction plant and equipment available for this job, with resume of work in progress or other data that will assure that the bidder is in a position to perform the work within the time specified.

In addition, if the bid exceeds \$1,000,000, the bidder shall furnish upon request, a certified statement listing:

(a) Each contract awarded to him within the preceding three-month period exceeding \$1,000,000 in value with brief description of the contract.

(b) Each contract awarded to him within the preceding three-year period not already physically completed and exceeding \$5,000,000 in value with brief description of the contract.

(c) If the prospective Contractor is a joint venture, each joint venture member will be required to submit the above defined certification. There shall also be furnished any other available information which will serve to substantiate the bidder's qualifications as a responsible prospective Contractor. (KCD APR 84)

#### 1.9 PERFORMANCE OF WORK BY CONTRACTOR

Bidder's attention is directed to SPECIAL CLAUSE titled "Performance of Work by Contractor." The successful bidder will be required to furnish the Contracting Officer, a description of the work which he will perform with his own organization (e.g., earthwork, paving, etc.), the percentage of the total work this represents, and the estimated cost thereof. Such description of work to be performed by the Contractor's own organization shall be furnished to the Contracting Officer within 10 days after award of the contract.

#### 1.10 LABORATORY AND TESTING FACILITIES

The Contractor shall provide and maintain all measuring and testing devices, laboratory equipment, instruments, transportation, and supplies necessary to accomplish the required testing. All measuring and testing devices shall be calibrated at established intervals against certified standards. The Contractor's measuring and testing equipment shall be made available for use by the Government for verification of their accuracy and condition as well as for any inspection or test desired pursuant to the

CONTRACT CLAUSE titled "Inspection of Construction." The location of the laboratory shall be convenient to the site such that test results are available prior to proceeding with the next sequential phase of the work. (KCD)

1.11 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

(a) This provision specifies the procedure for determination of time extensions for unusually severe weather in accordance with the CONTRACT CLAUSE titled "Default: (Fixed Price Construction)." In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

(1) The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

(2) The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

(b) The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities for the duration of the project.

Note: After the original contract completion date has passed, adverse weather that causes delay for the completion of the project will be granted day-for-day without deducting anticipated adverse weather delay days.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY

WORK DAYS BASED ON (5) DAY WORK WEEK

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(7)	(4)	(4)	(4)	(5)	(5)	(4)	(4)	(4)	(3)	(3)	(4)

((c) Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the Contractor shall record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical path activities for 50 percent or more of the Contractor's scheduled work day.

\* Monthly anticipated weather delay days shall be adjusted proportionally if work is performed in a work week with greater than or less than a five-day work week. The following formula shall be used to adjust the monthly anticipated weather delays:

adjusted monthly anticipated weather delays - **A** multiplied by (**B** divided by **C**; where:

**A** = The monthly anticipated adverse weather delay for a particular month based on a five-day work week.

**B** = The actual average number of days worked per week during that particular month.

**C** = The number five (5).

eg., If the monthly anticipated adverse weather delay for January based on a five day work week is 10 days, but the Contractor actually worked an average of a six-day work week for that month, the monthly anticipated weather delay would be adjusted by applying the above formula as follows:  $10 \times (6/5) = 12$  days.

#### 1.12 REQUIRED INSURANCE SCHEDULE

In accordance with CONTRACT CLAUSE titled "Insurance - Work On A Government Installation," the Contractor shall procure and maintain during the entire period of his performance under this contract the following minimum insurance.

Type	Amount
Workmen's Compensation State Statute	coverage complying with applicable
Employers' Liability	minimum amount of \$100,000.00
General Liability on Comprehensive Form of Policy which includes, but is not limited to, insurance for all work required herein	minimum limits of \$500,000 per occurrence for bodily injury
Comprehensive Automobile Liability	minimum limits of \$200,000 per person and \$500,000 per occurrence for bodily injury, and \$20,000 per occurrence for property damage

(End of clause)

#### 1.13 CONTRACTOR-FURNISHED EQUIPMENT DATA

At or before 30 days prior to final inspection and acceptance of the work, the Contractor shall submit the data mentioned in the following subclauses.

(1) Equipment List. An itemized equipment list showing unit retail value and nameplate data including serial number, model number, size, manufacturer, etc., for all Contractor-furnished items of mechanical equipment, electrical equipment, and fire protection systems installed under this contract.

(2) Guarantees. A list of all equipment items which are specified to be guaranteed accompanied by a copy of each specific guarantee therefor. For each specific guaranteed item, a name, address, and telephone number shall be shown on the list for subcontractor who installed equipment, equipment supplier or distributor and equipment manufacturer. The completion date of the guarantee period shall correspond to the applicable specification requirements for each guaranteed item.

(3) Warranty Service Calls. The Contractor shall furnish to the Contracting Officer the names of local service representatives and/or Contractors that are available for warranty service calls and who will respond to a call within the time periods as follows: 4 hours for heating, air-conditioning, refrigeration, air supply and distribution, and critical electrical service systems and food service equipment, and 24 hours for all

other systems. The names, addresses, and telephone numbers for day, night, weekend, and holiday service responses shall be furnished to the Contracting Officer and also posted at a conspicuous location in each mechanical and electrical room or close to the unit.

1.14 DATE OF SAFETY AND HEALTH REQUIREMENTS MANUAL (EM 385-1-1)

(a) The date of the U.S. Army Corps of Engineers Safety and Health Requirements Manual in effect on the date of this solicitation is 3 September 1996. See Section 00700, Contract Clause titled "Accident Prevention."

(b) Section 06.I of EM 385-1-1 is deleted. Job hazard analysis for confined space entry procedures is still required, as per 01.A.09 of EM 385-1-1. OSHA Standards 29 CFR 1910.146 or 29 CFR 1926 shall apply.

(c) Before initiation of work at the job site, an accident prevention plan, written by the prime contractor for the specific work and hazards of the contract and implementing in detail the pertinent requirements of EM 385-1-1, will be reviewed and found acceptable by designated Government personnel.

1.15 COMPLIANCE WITH OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA)

The Contractor shall comply with OSHA standards as well as the most current edition of the Corps of Engineers General Safety Requirements Manual (EM 385-1-1). The OSHA standards are subject to change and such changes may affect the Contractor in his performance under the contract. It is the Contractor's responsibility to know such changes and effective dates of changes.

1.16 CONSTRUCTION EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE

Whenever a modification or equitable adjustment of contract price is required, the Contractor's cost proposal for equipment ownership and operating expenses shall be as set forth in SPECIAL CLAUSE titled "Equipment Ownership and Operating Expense Schedule." A copy of EP 1110-1-8 "Construction Equipment Ownership and Operating Expense Schedule" dated August 1995 can be ordered from the Government Printing Office (GPO) by calling Telephone No. 202-512-1800.

1.17 SHOP DRAWINGS

The Contractor's attention is directed to clause "Specifications and Drawings for Construction" of the Contract Clauses.

1.18 SUBMITTALS

(a) Submittal Procedures. See Division One SECTION: SUBMITTAL PROCEDURES.

(b) Shop Drawings shall be submitted in ample time to secure approval prior to the time the items covered thereby are to be delivered to the site. ENG Form 4025 and 4026 shall be used for the transmittal of shop drawings. Unless otherwise specified, shop drawings shall be submitted not less than 30 days before commencement of fabrication of fabricated items and not less than 15 days before delivery of standard stock manufactured items. Where materials are stock with the manufacturer, catalog data, including specifications and full descriptive matter, may be submitted as shop drawings. When catalog includes nonapplicable data, the applicable data

shall be clearly designated and identified by item number, item name, and name of manufacturer. Shop drawings submitted (including initial and final submittals) shall be reproductions on high quality paper with clear and legible print. Drawings shall generally be bordered a minimum of one inch and trimmed to neat lines and unless otherwise specified, the minimum scale shall be 3/8-inch to the foot. Shop drawings quality will be subject to approval. Each shop drawing, including catalog data, shall be identified with a title block including the name of Contractor, contract number, name and location of project, and name of item of work or structure to which the shop drawing applies. Material fabricated or delivered to the site before approved shop drawings have been returned to the Contractor will be subject to rejection. NO CONSTRUCTION OR INSTALLATION SHALL BE DONE FOR ANY ITEM REQUIRING SHOP DRAWINGS, UNTIL ALL SHOP DRAWINGS FOR THAT ITEM HAVE BEEN APPROVED.

(c) As-Built Shop Drawings: Upon completion of the work under this contract, the Contractor shall furnish five complete sets of prints or one complete set of reproducibles of all shop drawings as finally approved. These drawings shall show all changes and revisions made up to the time the equipment is completed and accepted. The quality of the reproducibles and prints is subject to approval.

(d) As-Built Drawings: The Contractor shall maintain three separate sets of red-lined, full scale, as-built construction drawings marked up to fully indicate as-built conditions. These drawings shall be maintained in a current condition at all times until completion of the work, and shall be available for review by Government personnel at all times. All variations from the contract drawings, for whatever reason, including those occasioned by modifications, optional materials, and the required coordination between trades, shall be indicated. These variations shall be shown in the same general detail utilized in the contract drawings. In addition, the Contractor shall indicate on the As-Built Drawings, the brand-name, description, location, and quantity of any and all materials used which contain asbestos. The Contractor shall also be responsible for updating the Government-furnished CADD files to reflect the current as-built conditions throughout the duration of the project. The updated CADD design files shall be maintained in the AutoCADD format consistent with the graphic standards established in the CADD contract drawings provided by the Government. The Contractor will be provided a copy of the Tri-Service CADD standards to facilitate his efforts in the maintenance of design files. The updated CADD files shall be reviewed by the Government on a monthly basis during the progress payment evaluation. The Contractor shall be prepared to demonstrate the status of the updated CADD files in his on-site office. The as-built utility drawings shall show locations and elevations of all underground new utilities and existing utilities encountered, including dimensions from permanent structures and/or survey locations. The submittal requirements for as-built utility drawings shall be shown as separate activities on the Contractor-prepared network analysis. Upon completion of the work, the marked-up drawings and the updated CADD files shall be furnished to the Contracting Officer on 8 mm tape or CD. In multiphased construction where portions of a system are to be turned over to the user prior to completion of the project, the marked-up drawings for that portion shall be furnished to the Contracting Officer at that time. (MRD ltr 30 Oct 70 and KCD 8 Apr 91)

(e) CADD Files: The Government will provide to the Contractor, within 30 calendar days after Notice of Award, copies of the CADD computer files of the contract drawings for the production of as-built drawings. These files will be in Intergraph Microstation format. The Government provides no

warranty, expressed or implied, of the CADD computer files. The Contractor shall assume all responsibility to verify the CADD drawing files. The Contractor will not utilize the CADD drawing computer files to resolve dimensional or other discrepancies. The Government will not guarantee the measurable accuracy of the CADD drawing computer files.

(f) Purchase Orders: Each purchase order issued by the Contractor or his subcontractors for materials and equipment to be incorporated into the project, shall be maintained on file at the Contractor's field office for inspection and review by Government representatives. Each purchase order shall (1) be clearly identified with applicable DA contract number, (2) carry an identifying number, (3) be in sufficient detail to identify the material being purchased, (4) indicate a definite delivery date, and (5) display the DMS priority rating. At the option of the Contractor, the copies of the purchase orders may or may not indicate the price of the articles purchased. (MRD Ltr 22 Oct 74)

(g) Color Boards:

1. The Contractor shall submit a minimum of three (3) complete sets of color boards within 120 calendar days of receipt of Notice to Proceed. Construction color boards shall be submitted in a 3-ring notebook binder with all materials securely mounted on rigid 8-1/2 by 11-inch presentation (mat) board, with a maximum spread of 25-1/2 by 33 inches for foldouts, clearly coded regarding location of materials in the facility.

2. An index shall be provided listing pertinent contract specifications and drawings for each sample and any proposed substitutions or variances shall be so designated. The Contractor shall also certify, in writing, that all submittal items technically comply with the project specifications.

3. Color boards shall reflect all actual finish textures, patterns, and colors required for this contract as specified on the Interior Room Finish Schedule, the Exterior Finish Schedule and Interior Finish Materials Legend located in the Contract Drawings, and the sample requirements of the submittal registers. All materials must be labeled with the manufacturer's name, pattern and color reference. Patterned material samples (i.e., carpet) must be of sufficient size to enable evaluation of the pattern. Samples shall be keyed or coded to match any key or code system in the Contract Drawings.

4. The Contractor shall express mail a minimum of three (3) copies of the color boards to the Contracting Officer. The Contracting Officer will forward one copy of the colorboards to CENWK-EC-D for review and concurrence. Concurrence or comments will be provided not later than 45 calendar days after receipt of the submittal. This paragraph does not cover the quality of finishing materials. The quality, physical requirements, and method of installation shall be submitted with the appropriate shop drawings. The Contractor shall not submit any of the above requirements with the color boards. Specific locations where the various materials are required are shown on the drawings.

#### 1.19 SPECIAL REFERENCES

(a) Shop Drawings. Bidder's attention is directed to SPECIAL CLAUSE titled "Shop Drawings." The basic requirements for Shop Drawings are set forth in the CONTRACT CLAUSES and SPECIAL CLAUSES.

(b) Approved Equal. Bidder's attention is directed to SPECIAL CLAUSE

titled "Approved Equal."

(c) Payment to Subcontractors. Bidder's attention is directed to SPECIAL CLAUSE titled "Payments to Subcontractors."

#### 1.20 DIFFERENCES IN DRAWINGS

In addition to the provisions of CONTRACT CLAUSE paragraph "Specifications and Drawings for Construction," the structural drawings shall govern in cases where they differ from the architectural drawings.

#### 1.21 DAMAGE TO WORK (1966 MAR OCE)

The responsibility for damage to any part of the permanent work shall be as set forth in the CONTRACT CLAUSE titled "Permits and Responsibilities." However, if, in the judgment of the Contracting Officer, any part of the permanent work performed by the Contractor is damaged by flood or earthquake, which damage is not due to the failure of the Contractor to take reasonable precautions or to exercise sound engineering and construction practices in the conduct of the work, the Contractor will make the repairs as ordered by the Contracting Officer and full compensation for such repairs will be made at the applicable contract unit or lump sum prices as fixed and established in the contract. If, in the opinion of the Contracting Officer, there are no contract unit or lump sum prices applicable to any part of such work an equitable adjustment pursuant to CONTRACT CLAUSE titled, "Changes," of the contract, will be made as full compensation for the repairs of that part of the permanent work for which there are no applicable contract unit or lump sum prices. Except as herein provided, damage to all work (including temporary construction), utilities, materials, equipment and plant shall be repaired to the satisfaction of the Contracting Officer at the Contractor's expense, regardless of the cause of such damage.

#### 1.22 WORK ADJACENT TO ROADS AND HIGHWAYS

Where the construction work is on or adjacent to, or involves hauling over public or private roads, streets, or highways, all herein referred to as "roads," the said roads shall, except as otherwise specified or directed, be kept open for traffic at all times during the construction period. Further, the Contractor shall, during said construction, provide, erect and maintain warning signs, lanterns or torches or other safety devices and, when necessary, provide flagmen for protection of traffic to the satisfaction of the Contracting Officer and local authorities. The Contractor shall keep the right-of-way of the roads free of debris that might be caused to accumulate thereon by his operations, and upon completion of the work, shall clean up the said roads and repair any damage to the roads occasioned by his operations under this contract to the satisfaction of the Contracting Officer and local authorities having jurisdiction. The drainage from the roads shall not be obstructed by the construction work. The Contractor shall be responsible for obtaining and paying for all permits required for operation on all roads.

#### 1.23 APPROVED EQUAL

The drawings and the TECHNICAL PROVISIONS of these specifications may, in some instances, refer to certain items of equipment, material, or article by trade name. References of this type shall not be construed as limiting competition, but shall be regarded as establishing a standard of quality. In this respect, the Contractor's attention is directed to CONTRACT CLAUSE

titled "Material and Workmanship."

#### 1.24 SCHEDULE OF WORK

The Contractor's attention is directed to CONTRACT CLAUSE titled "Schedule for Construction Contracts," wherein if, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer.

#### 1.25 UPKEEP OF ROADWAY AREAS WITHIN A MILITARY INSTALLATION WHICH THE CONTRACTOR USES

In addition to the requirements in CONTRACT CLAUSE titled "Operations and Storage Areas," the Contractor shall comply with the following requirements: Where the construction work is on or adjacent to, or involves hauling over public roads, streets, or highways located on a military installation, all herein referred to as "roads," the said roads shall except as otherwise specified or directed, be kept open for traffic at all times during the construction period. The Contractor shall keep the roads including adjacent construction site free of debris including litter, waste construction material, mud etc., that might be caused to accumulate thereon by his operations, and upon completion of the work, shall clean up the said roads and construction site and repair any damage occasioned with his operations under this contract to the satisfaction of the Contracting Officer. The drainage from the roads shall not be obstructed by the construction work.

#### 1.26 PROTECTION OF UTILITY LINES

(a) It shall be the Contractor's responsibility to protect all existing utility lines from damage during excavation for utilities systems. Any damage resulting to existing utility systems shall be repaired by the Contractor, to the satisfaction of the contracting officer, at no additional cost to the Government.

(b) All requests for access and/or locations must be made through the Contracting Officer's Representative (COR) or Resident Engineer. The Base Engineer will work directly with the Resident Engineer to provide timely information to the Contractor.

#### 1.27 MODIFICATIONS PRIOR TO DATE SET FOR OPENING BIDS

The right is reserved, as the interest of the Government may require, to revise or amend the specifications or drawings or both prior to the date set for opening bids. Such revisions and amendments, if any, will be announced by an amendment or amendments to this Invitation for Bids. If the revisions and amendments are of a nature which requires material changes in quantities or prices bid or both, the date set for opening bids may be postponed by such number of days as in the opinion of the issuing officer will enable bidders to revise their bids. In such cases, the amendment will include an announcement of the new date for opening bids. (KCD APR 84)

#### 1.28 EXPEDITING NOTICE TO PROCEED

Notwithstanding the requirements of Block 12 on page 00010-1 of SECTION 00010 and SECTION 00100 paragraph titled "Late Submissions, Modifications, and Withdrawals of Bids," in order to expedite award of contract and

issuance of NOTICE TO PROCEED, it is requested that an officer of the company or corporation determined to be the successful bidder shall appear in the office of the Commander, Kansas City District, Corps of Engineers, 757 Federal Building, 601 East 12th Street, Kansas City, Missouri, for signing contract documents. Therefore, upon written acceptance of this bid, mailed or otherwise furnished within 60 calendar days after the date of opening of bids, it is requested that the successful bidder shall within 48 hours after receipt of notification appear in the office of the Commander and execute Notice to Proceed documents, and give performance and payment bonds on Government Standard forms 25 and 25A with good and sufficient surety. It is also requested that the successful bidder furnish insurance certificates required in SPECIAL CLAUSE titled "Required Insurance Schedule" at this time.

#### 1.29 UNEXPECTED HAZARDOUS SUBSTANCES

In the event that suspected hazardous substances are revealed during construction activities, all such construction activities in the immediate area shall be immediately suspended. Hazardous substances for purposes of this specification only, shall be defined as CERCLA hazardous substances, infectious or radioactive wastes, asbestos or oil. The Contractor shall leave the materials undisturbed and shall immediately report the find to the Contracting Officer's Representative (COR) so that proper authorities can be notified. The Contractor shall not resume construction activities in the vicinity of the suspected hazardous substances until written clearance is received from the COR. Identification and removal of any such materials will be conducted in accordance with all Federal, state and local environmental laws and regulations according to the CONTRACT CLAUSE titled "Differing Site Conditions."

#### 1.30 UNEXPECTED DISCOVERY OF ASBESTOS ON CONSTRUCTION (RENOVATION AND DEMOLITION)

The buildings and areas to be renovated or demolished have been surveyed for the presence of asbestos-containing materials. This survey is not a warranty that asbestos-containing materials are either not present or limited to the amounts found in the survey. Should suspected asbestos-containing material be encountered, the Contractor shall promptly, and before the conditions or the substance encountered is disturbed, give a written notice to the Contracting Officer of the suspected asbestos-containing material conditions encountered. As directed by the Contracting Officer, the Contractor shall remove and dispose of any and all asbestos-containing material as necessary to accomplish the required work which shall be performed in accordance with all pertinent local, state, and federal laws. An equitable adjustment will be made to the Contractor in accordance with the CONTRACT CLAUSE entitled "Changes", for the additional work directed by the Contracting Officer.

#### 1.31 KANSAS SALES AND USE TAX

In accordance with FAR clause 52.229-3, notice is given that the contract price excludes the Kansas sales tax and compensating (use) tax on all sales of tangible personal property and materials purchased by the Contractor or subcontractors for the construction of projects, including repairing or remodeling facilities, for the United States. In accordance with Kan. Stats. Anno., sec. 79-3606(e), the Contracting Officer will obtain from the State and furnish to the Contractor an exemption certificate for this project for use by the Contractor and subcontractors in the purchase of materials for incorporation in the project and of services. The Contractor

and the subcontractors shall furnish the number of such certificate to all suppliers from whom such purchases are made, and the suppliers shall execute invoices covering the same bearing the number of such certificate. Pursuant to a 1977 Amendment to K.S.A., 1976 Supp., 79-3606(e), effective 1 July 1977, the Contractor is required to retain all invoices for a period of five (5) years during which time these invoices are subject to audit by the Kansas Director of Taxation. Upon completion of the project, the Contractor shall complete the Project Completion Certification (Form STD 77, Rev. 6/77) in duplicate returning one copy to the Contracting Officer, and forwarding the other to the Kansas Director of Taxation. (KCD)

## 1.32 CONSTRUCTION/SITE MANAGEMENT STANDARDS

### 1.32.1 General

The following standards relate to the appearance of the construction site during the construction cycle, to temporary administrative and storage areas, and to service facilities needed for execution and completion of the work.

#### 1.32.1.1 Two Sites

For most construction projects, the Base Civil Engineer will provide the Contractor with two sites, the primary construction site and a supplemental storage site. The supplemental storage site may not be in close proximity to the construction site, but at a site designated by the Base Civil Engineer out of the view of the general public. The primary site is the construction site.

#### 1.32.1.2 Visual Standard

A visually acceptable site at McConnell Air Force Base is an important construction standard. A clean, well-kept site will help ensure compliance with the safety and environmental requirements of the contract. Contractors' trailers and storage buildings must follow the base paint standards. Contractors shall maintain the trailers or storage buildings in good condition or must remove them. Contractors are responsible for the security of their property and general housekeeping of the area(s).

#### 1.32.1.3 Site Plan

Prior to starting the work, the Contractor shall submit site plans to the Contracting Officer for approval showing the layout and details of all temporary facilities used for this contract. The base approval authority, normally the Base Civil Engineer, must approve the plan. The plan shall include the location of the safety and construction fences, location of all site trailers, equipment and material storage areas, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas. Site photographs prior to the start of work may be included with the plan. At completion of the work, the Contractor shall remove the facilities and restore the site to its original condition.

#### 1.32.1.4 Dirt and Dust Control Plan

The Contractor shall submit truck and material haul routes along with a plan for controlling dirt, debris, and dust on base roadways. As a minimum, the plan shall identify the subcontractor and equipment for cleaning along the haul route and measures used to reduce dirt, dust, and debris from roadways.

### 1.32.2 Contractor's Temporary Facilities

#### 1.32.2.1 Administrative Field Offices and Material Storage Trailers

The Contractor's administrative field office and storage trailers shall be in like new condition and the exterior must be the base standard color. The office and trailers shall be located behind the construction fence unless otherwise indicated on the drawings. Storage of materials/debris under the trailers is prohibited.

#### 1.32.2.2 Material Storage Areas

The Supplemental Storage Area is for storage of items not immediately required at the construction site. The location is indicated on the drawings. The Contractor is responsible for the security of the stored property and general housekeeping. The Primary Storage Area is limited to them materials that are needed within one week. The storage area shall be enclosed by a construction fence, unless otherwise indicated on the drawings.

#### 1.32.2.3 Dumpsters

The Contractor shall equip dumpsters with secure covers and paint them the standard base color. Covers shall be closed at all times, except when being loaded with trash and debris. Dumpsters shall be located behind the construction fence or out of the public view. Site dumpsters shall be emptied at least once a week, or as needed to keep the site free of debris and trash. If necessary, the Contractor shall provide 208-liter (55-gallon) trash containers painted the darker base color to collect debris in the construction site area. The trash containers shall be located behind the construction fence or out of the public view. The contractor shall empty the trash containers at least once a day. Large demolition normally requires a large dumpster without lids--these are acceptable but should not have debris higher than the sides before being emptied.

#### 1.32.2.4 Temporary Sanitation Facilities

All temporary sewer and sanitation facilities shall be self-contained units with both urinals and stool capabilities. The units shall be ventilated to control odors and fumes, and shall be emptied and cleaned at least once a week, or more often if required by the Contracting Officer. The doors shall be self-closing. The exterior of the units shall match the base standard color. The facilities shall be located behind the construction fence or out of the public view.

#### 1.32.2.5 Grass Cutting

The Contractor shall cut grass (or annual weeds) within the construction and storage sites to a 4-inch height at least once a week during the growing season unless the grass area is not visible to the public. The grass around fences shall be trimmed at the time of grass cutting. Grass or weeds on stockpiled earth shall be maintained as described above.

### 1.33 FORCE PROTECTION

The plans, specifications, and construction shall comply with the latest

force protection criteria. Those criteria are classified "For Official Use Only". The force protection criteria will be furnished to the Contractor after award. Should the force protection criteria require a change in these bid documents, those changes will be handled in accordance with the contract clause titled "Changes".

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

\* \* \* \* \*

-- End of Section --

## SECTION [01140]

## BASE STANDARDS

[ ]

## PART 1 GENERAL

## 1.1 INFRASTRUCTURE

## 1.1.1 General

## 1.1.1.1 Utilities

- a. Written request to the Base Civil Engineer will be required thirty (30) calendar days prior to a scheduled utility outage.
- b. Provide utility meters (natural gas, electric, and water) for use during construction. Sales rates to contractors will be calculated in accordance with Air Force Regulation 91-5. (Applicable to Military Construction Program projects only.)
- c. Provide tracer wire on all buried lines, including water, sanitary sewer, and natural gas. Tracer wire shall be accessible from the surface for use with tracing machines.
- d. All utilities run under roadways shall be jack and bored under the roadways. Open cut trenching of roadways will not be permitted unless directed, in writing, by the Base Civil Engineer. If steel casement is used, cathodic protection is required.

## 1.1.1.2 Water Supply

- a. The existing source of supply for water is as shown on the base utility maps. Tie-in shall be as directed by the Base Civil Engineer. All plan locations shall be verified.
- b. Water main piping is PVC conforming to ASTM d1784, Class 12454B, Schedule 40 for 3" diameter and larger.
- c. Water lines shall be buried a minimum of 42 inches for freeze protection.
- d. Water meter shall be a turbine type and DDC compatible. Provision shall be made for direct reading of this meter. Provide a bypass for the water meter in the event that the meter would require maintenance. Provide water meters in the Mechanical Room if possible.
- e. Provide separate lines for fire protection supply and domestic supply from the main to the facility. One supply line and split in the mechanical room is not acceptable.

## 1.1.1.3 Waste Water Treatment

- a. The existing sewage system is as shown on the base utility maps. Tie-in shall be as directed by the Base Civil Engineer. All plan locations shall be verified.

b. Sanitary sewer main piping is PVC conforming to ASTM D3034, type PSM, SDR 35 with a flexible elastomeric seal joint.

#### 1.1.1.4 Gas Supply

a. The existing gas supply is as shown on the base utility maps. Tie-in shall be as directed by the Base Civil Engineer. All plan locations shall be verified.

b. Gas main piping is plastic conforming to ASTM D2513 CD PE3 406. New gas service line to be of the same material. Shut off valves shall be PVC. An anodeless riser shall be provided at the building entrance.

c. The base natural gas distribution system is a medium pressure system (less than 50 psig). A pressure regulator is required for all end use applications.

d. Natural gas pipelines shall be buried a minimum of 18 inches below grade.

e. Utility meter shall conform to Military Standard MIL-M-18294, rotary type and be DDC compatible. Provisions shall be made for direct reading of this meter.

#### 1.1.1.5 Corrosion Control/Cathodic Protection

a. Cathodic protection shall be provided for buried natural gas lines, fuel lines, fuel oil tanks, oil/water separators, tank hold down straps, boring sleeves, steam and condensate lines, chilled water lines, electrical conduit, PIV valves, fire hydrant valves, and any other ferrous metal materials in accordance with AFR 85-5 and MAFBR 81-1.

b. Construction inspection shall be accomplished by the Base Cathodic Protection technician prior to backfill. An AF Form 1686, Cathodic Protection Operating Log for Sacrificial Anode System (Attachment 2) and a Backfill Inspection (Attachment 1) shall be filled out and turned over to the Air Force prior to completion of the project.

c. Insulation coupling or union shall be installed above ground at the service entrance.

d. Provide one test station on grade encased in concrete at each cathodic protection site.

e. Anodes shall be 17 lb. bare, magnesium-manganese anode, 45 lb. packaged anode, corresponding to the applicable chemical composition listed in the following table:

## PERCENT BY WEIGHT

ELEMENT	MG-MN ALLOY
Aluminum	0.010 Max.
Manganese	0.50 - 1.30
Copper	0.020 Max.
Iron	0.030 Max.
Nickel	0.001 Max.
Others	0.05 each or 0.30 Max. Total
Magnesium	Balance

## 1.1.1.6 Electrical

- a. All secondary and primary service shall be underground concrete encased duct bank using XLP cable with concentric neutral compatible with the base system. Provide 4 inch conduit, Schedule 80 PVC encased with 4000 psi concrete, minimum 3 inches. Concrete shall be dyed red. Trace tape shall be laid above the encased duct.
- b. Terminations for coming down the pole will be Quik-Term 2 by 3M or equal. Above ground conduit shall be galvanized steel, 4 inch minimum, painted to match Fed Std 595b, #X0122.
- c. All transformers shall be pad mounted, color to match Fed Std 595 b, #X3617. Transformer shall be connected wye primary. PVC conduit may be brought up into the transformer. Only copper conductors shall be used. Transformer shall be located next to the building. Transformers shall be provided with a weather proof key lock. Base standard are Master "Weather Tough", key number 10G010.
- d. Fuses and fuse holders shall be provided by the contractor for use in existing switches.
- e. Underground terminations are not acceptable. All terminations for the underground duct system shall be made above ground in pedestals.
- f. Provide electric meter on transformer of the integral-pulse type remote kWh and 15 minute interval demand metering. Meter shall be compatible with the base DDC system SIEBE (Barber Colman) Network 8000. Provisions shall be made for direct reading of this meter.
- g. Existing street lighting circuit is 480 volts to ground consisting of one hot leg and a neutral. Any street lighting removed MUST be replaced. Service shall be underground. Street Light lamp shall be a 400 watt high pressure sodium lamp mounted on a 40 foot round tapered steel pole with a dark bronze finish. Lights to be spaced to maintain a minimum of 1 foot candle minimum.
- h. Parking area lighting to be provided and tied into the building circuit unless otherwise directed, in writing, by the Base Civil Engineer. Provide one photoelectric cell for the entire parking area lighting system. Average foot candles in the parking area shall be ½ foot candles. Provide 400 watt high pressure sodium lamps for parking lots and drives. Style shall be US Army Corps of Engineers type 401. Poles to be 30 foot, round tapered steel with baked on dark bronze finish.

i. Sidewalk light fixtures shall be a square bollard, 42" tall of extruded aluminum or steel with an impact resistant acrylic or polycarbonate lens and aluminum reflector with semi-specular clear finish. Bollard shall have a dark bronze baked enamel finish. Sidewalk light fixtures and exterior building lighting shall be tied into the building circuit, unless otherwise directed, in writing, by the Base Civil Engineer.

j. Control panels for parking area lighting, sidewalk lighting and exterior building lighting shall be located in close proximity with the main switchgear.

k. Communications Electrical requirement. The Communications-Computer Equipment Room (CER) shall have a 220 volt single phase outlet. The location of the outlet will be determined by the Communications Squadron.

#### 1.1.1.7 Exterior Communication Requirements

Provide underground connectivity from the nearest manhole to the communications-computer equipment room (CER) with one four inch open duct and one four inch multi-cell duct. The Communications Squadron will determine the nearest tie-in point and coordinate on all splicing at the tie-in point.

- Exterior Cable Specifications. Underground cable shall be 24 gauge, jell-filled copper cable and multi-mode fiber optic cable. Both copper and fiber optic cable size and type will be determined by the Communications Squadron. All cable shall be in the four inch duct from the manhole to the CER.

- Copper cable shall be pulled through the open four inch duct. The copper cable shall be terminated to R66 type 110 protectors.

- Fiber optic cable shall be pulled through the four inch multi-cell duct. Fiber optic cable shall be terminated with ST type connectors and ST compatible distribution box. The fiber optic distribution box will be either wall mounted or rack mounted as determined by the Communications Squadron.

#### 1.1.2 Roads

Written request to the Base Civil Engineer will be required fourteen (14) calendar days prior to scheduled road closures.

Access and parking for existing facilities must be maintained throughout construction.

#### 1.1.3 Base Services

Disposal of construction materials and demolition rubble shall be disposed of at an approved off-base landfill. All material shall be disposed of in strict accordance with all applicable federal, state, and local regulations. All permits and fees are the responsibility of the contractor.

### 1.2 ENVIRONMENTAL ISSUES

#### 1.2.1 Certificate of Compliance

The Environmental Certificate of Compliance shall be provided. Any environmental issues, including asbestos and lead-base paint abatement shall be addressed in the project documents. Testing shall be accomplished by the designer.

#### 1.2.2 PCB Concentrations

The Contractor shall provide to 22 CES/CEV documentation of the PCB concentrations in any new transformers provided in the contract.

#### 1.2.3 Special Clause

Authorization to Operate Radioactive Sources on Base: If the Contractor or any Sub-Contractor is proposing to use any radioactive equipment on McConnell AFB, he must have a valid Department of Health radioactive material license issued by any "Agreement State" or by the Nuclear Regulatory Commission (NRC). Other requirements to be met include, but are not limited to the following:

- a. Submit a complete listing of authorized source users.
- b. Submit proof of adequate training for each of the source users.
- c. Identify each instrument to be used by manufacturer name, model number, serial number, and specific source or sources which will be used with each instrument.
- d. Indicate the estimated date of initiation of operations at McConnell AFB.
- e. Provide in writing the location of equipment storage areas (if stored on McConnell AFB), estimated dates of initiation of operations and completion of activities, and a phone number to reach the source users.
- f. Provide notification by telephone to the Base Radiation Officer as to the date when the instruments(s) and its (their) respective radioactive source(s) is (are) actually brought on to the base and when it (they) is (are) permanently removed from the base, after completion of said activities.
- g. Complete an NRC Form 241 and forward same to:  
  
United States Nuclear Regulatory Commission  
Region 4  
Ryan Plaza Drive, Suite 1000  
Arlington, TX 76011  
  
Tel. No. (817) 860-8177
- h. The request for authorization and all supporting documentation must be forwarded to the following address for recommended approval by the base Radiation Safety Officer:

ATTN RADIATION SAFETY OFFICER  
AMDS/SGPB  
LEAVENWORTH STREET SUITE 6E4  
MCCONNELL AFB KS 6722103506

TEL. NO. (316) 652-5104

### 1.3 BASE DESIGN STANDARDS

#### 1.3.1 As-Built Drawings

Supply As-Built drawings on CD ROM in AutoCAD format. Provide Font Files (.SHX) and Menu (.MNU) files with these drawings.

#### 1.3.2 Architectural

##### 1.3.2.1 General

Design shall conform to MIL HDBK 1190 and any other applicable Air Force regulations, manuals and/or design guides.

##### 1.3.2.2 Exterior Finishes

All exterior finishes shall conform to the McConnell Air Force Base Architectural Compatibility Guide.

a. Base standard brick colors are Acme Brick No. 250 (field) and 308 (trim). Some facilities, due to the mass, may require a third brick color. Base standard for this brick is Acme Brick No. 300 (trim).

b. Mortar color shall match the light brick (field).

c. Base standard for standing seam metal roof color along the flight line is Fed Std 595b, #X3617 and all other areas is Fed Std 595b, #X0122, unless otherwise directed by the Base Civil Engineer.

##### 1.3.2.3 Signage

All interior and exterior signage shall comply with AFP 32-1097, U.S. Air Force Sign Standards Pamphlet and the Base Sign Plan. The base standard for exterior signage is Helvetica Medium, plastic lettering, color to match Fed Std 595b, #X0122. Color shall be throughout the material, not painted or baked on finish. Signage shall also comply with paragraph 10 of ETL 93-02, AMC Sign Standards.

##### 1.3.2.4 Ground Mounted Equipment

Ground mounted equipment including all mechanical and electrical equipment shall be located on concrete pads, away from public access, and screened from public view. Screening shall be in accordance with the McConnell Air Force Base Architectural Compatibility Guide and shall be constructed of the same materials as the exterior of the facility.

##### 1.3.2.5 Master Keying

All building locks shall be master keyed and conform to the Base Master Key Plan, which is maintained by the base locksmith. The base standard is as manufactured by Corbin.

##### 1.3.2.6 Interior Design and Finishes

Interior design and finishes shall be designed in accordance with AMC interior design standards and any other Air Force or AMC design guides.

### 1.3.3 Structural

#### 1.3.3.1 Soil Tests

Any soil classification or bearing capacity tests required to determine exact characteristics of the soil shall be the responsibility of the designer.

#### 1.3.3.2 Wells

No wells are developed on McConnell AFB property proper at the present time.

#### 1.3.3.3 Soils

The soils tend to be alkaline, with caliche deposits or hard pans developed in places.

#### 1.3.3.4 Irwin and Tabler Soils

The nature of the Irwin and Tabler soils on base, both of which are silty clays for the most part gives them an excessive shrink-swell potential with moisture, and a tendency to hold large amounts of water in their structure.

Both have liquid limits as high as 65 and plasticity indices as high as 35. This condition is a severe limitation on heavy construction and foundation loads in the areas where they occur.

#### 1.3.3.5 Base Soils

The base soils represent a major constraint on economical construction of structures with normal loading and on buried metal. This is due to the fine-grained, silty-fat clay nature of the soil, which tends to retain pore water and be very soft and unstable, and also to its high salt content, which makes it electrolytically corrosive to metals. Foundations in buildings on base have shifted and cracked due to these problem soils. Future construction plans for almost all areas of the base will have to address extraordinary foundation design, plastic utility pipe, utility tunnels, and subsurface drainage and similar measures. The predominant foundation type on base is the standard continuous spread type.

#### 1.3.3.6 Seismic

The base is seismic zone one (1). However, the Wichita/base area is free of major active fault structures and the region is relatively free of seismic activity. According to recent investigations, the area will experience seismic forces with a maximum effective peak acceleration of 5% of gravity and effective peak velocities of 1½ inches per second during any 50 year period, at the 90% confidence level.

#### 1.3.3.7 Snow Loads

Design for snow loads of 20 lbs/SF of the projected horizontal projection. Design for a wind pressure of 33 lbs/SF acting on the vertical surfaces.

#### 1.3.3.8 Concrete

Due to problems encountered on base caused by the base soils, concrete used in foundations shall have a minimum compressive strength of 4000 psi.

#### 1.3.3.9 Steel Studs

Steel studs shall be used in lieu of wood studs due to the subterranean termite that exists at the base.

#### 1.3.4 Disturbed Soil

All disturbed soil shall be treated for termites.

#### 1.3.5 Site Work

##### 1.3.5.1 Parking Lots, Drives, and Streets

Provide curb and gutter for parking lots, drives, and streets. Due to the nature of the base soils, all parking lots, drives, and streets shall have the subsurface soil stabilized with either lime or fly ash. Storm water drainage shall be taken underground into the existing storm drainage system whenever possible.

##### 1.3.5.2 Grass Sod

Base standard of grass sod is Buffalo, Hybrid Number 609; seed is Buffalo "Bison".

##### 1.3.5.3 Contractor Limitations

Contractor activities are to be restricted to the area determined on plans as "Construction Limits".

##### 1.3.5.4 Construction Sign

A construction sign, conforming to CTL 88-3 is required. Sign background shall be painted to match Fed Std 595b, #X3617, lettering, back of sign and all support structure to match Fed Std 595b, #X0122.

##### 1.3.5.5 Special Clause

The following clause shall be included in the Special Clauses section of the Specifications:

Work Clearance Permit: The Contractor is responsible for obtaining a Work Clearance Permit, AF Form 193, from Civil Engineering, Building 948, for any excavation work on Government property. The permit will contain drawings showing the existing buried utility lines. The drawings are accurate with the best information available to the Government, however, variances from the locations shown may be expected on occasion. Every attempt should be made by the contractor to contact knowledgeable personnel to assure what utilities are in the area and that their locations are accurate. When there is a question, digging will proceed with extreme caution to the extent of hand digging where utilities could be encountered. The average time to process a permit is fourteen (14) days. Southwestern Bell Telephone flags are good for ten (10) days and GTE flags are good for thirty (30) days. The permit must be renewed every thirty (30) days and it is the responsibility of the Contractor to renew the permit.

##### 1.3.5.6 Welding Permit

A welding permit is required prior to performing any welding or cutting operations and can be obtained at the Base Fire Station, Building 1200.

#### 1.4 SPECIAL CONSTRUCTION

##### 1.4.1 Construction Season

Construction season is generally 1 April through 30 October. Construction may proceed year round, however, with special provisions being made for the proper protection of work (protection and heating of concrete, for example).

##### 1.4.2 Construction Material

Construction material, in general, is available in the local market area for use by the Contractor.

##### 1.4.3 Special Clauses

The following paragraphs shall be included in the Special Clauses section of the Specifications.

###### 1.4.3.1 Access to the Work Area

Access to the Work Area: The Contractor shall submit a McConnell AF Form 114 to the Contracting Officer providing a list of all personnel requiring access to the work area during construction. First name, middle initial, and last name shall be included along with the Social Security number of each person and the start and completion dates of the work.

###### 1.4.3.2 Miscellaneous Contractor Access Procedures

Miscellaneous Contractor Access Procedures: Periodic Air Force exercises may or may not make daily entry procedures to work areas time consuming, requiring as much as an hour to gain access to a work area. In addition, all Contractor personnel may be required to leave an area and reaccomplish entry procedures. Contractor vehicles are subject to search prior to entering and exiting the base. In the event of an emergency that requires evacuation from the area, Contractor shall comply with the instructions the Security Police.

#### 1.5 MECHANICAL

##### 1.5.1 General

###### 1.5.1.1 Design

Design shall conform to MIL HDBK 1190, and the following ETL's (latest edition): 83-1, 83-7, 83-9, 84-2, 86-16, 87-4, 87-5, 88-4, 89-2, and any other Air Force Instruction, Regulations or ETL's not listed here.

###### 1.5.1.2 O&M Manual

Six copies of the Operations and Maintenance Manual shall be furnished for all mechanical equipment.

###### 1.5.1.3 Control Diagrams

Provide three control diagrams, one mounted under glass, and two forwarded to 22 CES/CEC, for each system. In addition, one copy of reproducible

control diagrams shall be provided.

#### 1.5.1.4 Training

Training, including troubleshooting, shall be provided by the Contractor for base personnel on all equipment.

### 1.5.2 Heating and Air Conditioning

#### 1.5.2.1 Heat Source

The source of heat for the facility shall be natural gas and shall be provided by a steel hot water boiler. If directed by the Base Civil Engineer, dual burner, natural gas and diesel, may be required.

#### 1.5.2.2 Indoor Design

Indoor design temperatures and ventilation rates shall conform to MIL HDBK 1190.

#### 1.5.2.3 HVAC

Zoning of HVAC systems shall be provided in all activity areas.

#### 1.5.2.4 Acoustical

Peak noise level shall be 78-80 dbA. The preferred sound criteria should be 35-45 dbA in primary and secondary spaces. Limit ambient noise level from mechanical systems.

### 1.5.3 Energy Management and Control System (EMCS)

#### 1.5.3.1 "Turn Key"

Provide a fully integrated "turn key" EMCS incorporating Direct Digital Control (DDC) that is totally compatible with the existing SIEBE (Barber Colman) Network 8000 DDC system and interfaced via telephone modems to the SIEBE (Barber Colman) Network 8000 Host, located in the EMCS Master Control Room (MCR), located in building 691.

#### 1.5.3.2 System Provisions

The system shall provide operator interaction and dynamic process manipulation, including overall system supervision, coordination and control.

#### 1.5.3.3 Testing

Provide testing of the MCR to the field equipment, site testing and adjustment of complete system.

#### 1.5.3.4 Training

Provide full instruction to designated personnel in the operation, operator programming and maintenance of the EMCS to include functional operation, operational changes, adjustments and maintenance. All parameters shall be changeable by the operators with the system operating on line.

#### 1.5.3.5 O&M Manual

Provide O&M Manuals under separate cover.

#### 1.5.4 Plumbing

##### 1.5.4.1 Shot Off Valves

Provide shut off valves for each plumbing fixture.

##### 1.5.4.2 Mop/Slop Sinks

Provide mop/slop sinks in janitors' closets.

##### 1.5.4.3 Floor Drains

Provide floor drains in all toilets and janitors' closets.

##### 1.5.4.4 Backflow Preventers

Backflow preventers shall be provided at the service entrance. Pressure across the backflow preventer shall not drop more than 2 to 3 psi.

##### 1.5.4.5 Service Entrance

Provide backflow preventers at the service entrance for the fire protection line and as a separate feed into the facility.

##### 1.5.4.6 Flushometers

Flushometers shall be used in all non-residential areas and in residential areas a 1.6 gallon toilet with a vacuum system shall be used.

##### 1.5.4.7 Piping

Provide Type L or K copper piping.

#### 1.5.5 Maintenance Considerations

##### 1.5.5.1 Mechanical Systems

Mechanical systems shall be designed with ease of maintenance and accessibility to mechanical equipment in mind. No mechanical equipment will be located on the roof of the facility.

##### 1.5.5.2 Corrosion Control

Chemical feed systems shall be provided on all boiler water systems for corrosion control chemicals.

#### 1.6 FIRE PROTECTION

##### 1.6.1 General

The design shall conform to the requirements of MIL HDBK 1008C, any applicable Engineering Technical Letters (ETL's) as well as NFPA codes. In some instances, Mil HDBK 1008C and the ETL's are more restrictive than the NFPA codes.

##### 1.6.2 Fire Alarm System

The base fire alarm system is a D-500 II Radio Alarm System manufactured by Monaco Enterprises Alarm System. In view of this, the equipment installed in the facility for reporting fires and/or hazardous conditions to the base fire station must be compatible with the base fire alarm system. Provide a new Monaco BT2-5 transmitter panel, transmitter antenna, and a graphic annunciator panel. Zoning of the facility will be determined after the PD stage.

#### 1.6.3 Other Devices

Other devices used for detection of fires by heat, smoke, and manual pull station may be those made by Monaco and/or other manufacturer's if all applicable NFPA standards are met.

#### 1.6.4 NFPA Standards

Pull boxes, emergency lighting, and illuminated exit signs are to be added as required by the NFPA standards.

#### 1.6.5 Water Supply

Water supply for fire protection will be from the base distribution system.

Fire pumps may be required. Hydrant flow data is available and will be provided after receipt of a written request. A separate fire protection supply line shall be provided. A PIV with tamper switch, etc. shall be provided on Fire Water supply.

#### 1.6.6 Facility Construction

Facility construction shall be in accordance with MIL HDBK 1008C. Fire extinguisher cabinets shall be fully recessed and shall be sized to accept a Government provided 10 pound extinguisher. Fire extinguishers shall be provided by the Base Fire Department. Exit lights shall have a red background. Alarms shall be audio visual. Pull stations of brushed metal are preferred.

#### 1.6.7 Manufacturer's Representative

A manufacturer's representative of the fire alarm system shall be present during all wiring, installation of devices and testing.

#### 1.6.8 Training

Training, including troubleshooting, on the fire alarm system shall be provided in addition to six copies of the O & M manuals. Included in the O & M manuals shall be wiring diagrams and troubleshooting guides for the entire system.

### 1.7 ELECTRICAL

#### 1.7.1 Design

Design shall conform to AFM 88-7 and 88-9; REA Specifications 804 and 806; applicable NFPA standards; IES Handbook; IEE Standards 141-196, 142-1972, 241-1974, and 242-1975 (or most recent publications); MIL HDBK 1190; MIL HDBK 1108B; National Electric Code; and the following ETL's (Latest editions): 83-3, 87-5, 87-9, 88-4, 88-5, and 89-2 and any other Air Force Instruction or Regulation, ETL or standards not listed here.

### 1.7.2 Lights

Provide lights by all exterior doors.

### 1.7.3 Distribution Panels

The main distribution panel locations will be dictated by the location of electrical load centers within the facility.

### 1.7.4 Emergency Lighting

Provide emergency lighting in ceiling fixtures or fixtures with recessed battery packs. Emergency lighting will be available in the hallway and other areas personnel are located.

### 1.7.5 Interior Lighting Levels

Interior lighting levels shall be provided in accordance with the design criteria in the Illuminating Engineering Society (IES) Lighting Handbook.

### 1.7.6 O&M Manuals

Provide six (6) copies of the operations and maintenance manuals for all electrical equipment. Provide training for all systems. If a generator system is included as part of the facility, O & M manuals (six copies) shall be provided under separate cover, with troubleshooting guides included. Training shall be provided, including troubleshooting.

### 1.7.7 Surface Mounting of Cable

Surface mounting of conduit, cable, and accessories will not be permitted.

### 1.7.8 Transfer Switch and Disconnect

A double throw transfer switch and quick disconnect (male/female) connector shall be added to the electrical system on all new facilities. This will allow generator quick connect/disconnect during electrical outages. Provide switch, male/female disconnects and cable to support generator.

### 1.7.9 Generator System

The generator system shall have an automatic transfer switch.

## 1.8 COMMUNICATION SYSTEM

### 1.8.1 Communications-Computer Equipment Room (CER)

#### 1.8.1.1 CER Area

A separate secure and ventilated CER shall be provided on the first floor of each facility. The area of the CER must be at least 100 square feet.

#### 1.8.1.2 Wiring Type

Wiring for telephones and LAN networks shall consist of two 8-wire EIA/TIA category 5 compliant cables, with a maximum allowable distance of 100 meters, and shall be Integrated Services Digital Network (ISDN) compatible.

### 1.8.1.3 Wiring Details

The lines shall be terminated on fire retarding, shellacked, ¾ inch A/C 4' x 8' sheet of plywood. Distribution frames and conduit shall be of sufficient size to allow for 10% growth. Backboard shall have two 120 VAC 60 Hz four-plex outlets and an isolated dedicated ground. Each four-plex outlet will be feed with a separate 20 amp circuit breaker.

### 1.8.1.4 Telephone and LAN Cables

Telephone and LAN cables shall be kept separate from each other in the CER. Telephone cables shall be terminated on the left side of the backboard, and LAN cables, if mounted on the backboard, shall be terminated on the right.

a. Telephone cables shall be terminated on 66 MI-50 blocks and mounted on 89B brackets on the backboard.

b. LAN cables shall be terminated on a 96 port patch panel that will be wall or rack mounted as determined by the Communications Squadron. If it is wall mounted, it will be mounted on the backboard.

### 1.8.1.5 CER Placement

The CER shall be separate and free of any electrical panels or mechanical equipment.

### 1.8.1.6 Specific LAN Requirements

Wiring for the network clients shall be solid conductor twisted pair (24 AWG) and will consist of four pair/eight conductor wire category 5 compliant with a maximum distance of 100 meters. If distances increase over 100 meters, the Communications Squadron will identify another type of media to use.

## 1.8.2 Cross-Connect (C-C) Communications Closet

### 1.8.2.1 C-C Placement

There will be a C-C communications closet on each floor of the facility except for the first floor. The CER will satisfy first floor requirements.

### 1.8.2.2 C-C Details

Lines shall be terminated on fire retarding, shellacked, ¾ inch A/C 4' x 8' sheet of plywood. Distribution frames and conduit shall be of sufficient size to allow for 10% growth. Backboard shall have two 120 VAC 60 Hz four-plex outlets and an isolated dedicated ground. Each four-plex outlet will be feed with a separate 20 amp circuit breaker.

### 1.8.2.3 Circuit Connectivity

The facility shall be pre-wired from the CER to each telephone outlet jack in 3/4 inch conduit. Plenum rated cable shall be used where required by NFPA standards.

a. All cable in the CER and C-C communications closets shall be documented and tagged by room and jack number to indicate its location and associated jack number.

b. A 12 inch "above the ceiling" cable trough/trough/raceway will be used to connect rooms. The trough/raceway shall run on proper support structures using the most direct route to the CER and/or C-C communications closets.

#### 1.8.2.4 C-C Communications Closets Placement

The C-C communications closets shall be separate and free of any electrical panels or mechanical equipment.

#### 1.8.3 Office Communications Requirements

##### 1.8.3.1 Wiring and Jacks

Wiring and jacks shall be based on the single-line instrument concept.

a. Outlets for single-line telephone and LAN networks shall be dual RJ-45S type modular outlet jacks.

b. Each outlet jack shall be numbered on the outlet and shall be wired with four pairs (eight conductors). The top outlet will be for telephone use, and the bottom outlet will be for LAN use.

c. In office areas, the dual modular outlets shall be placed every 10 feet around the perimeter of each room.

##### 1.8.3.2 Outlets.

An RJ11 type outlet, to support wall mounted telephones, shall be placed in each CER, C-C communications closet, and electrical/mechanical room.

#### 1.8.4 Acceptance Testing

##### 1.8.4.1 Category 5 Cables

Category 5 cables shall meet or exceed a 100 megahertz data rate when terminated.

##### 1.8.4.2 Multi-mode Fiber Optic Cable

Multi-mode fiber optic cable shall meet or exceed 500 megahertz-Km.

#### 1.8.5 Surface Mounting

Surface mounted conduit, cables, and accessories will not be permitted.

#### 1.8.6 Deviations

Deviations to the above listed criteria must be approved by the Communications Squadron.

#### 1.9 LMR REQUIREMENTS

Install a 2 3/4 inch pipe on the roof of the structure. This mast must be three feet high and connected to the building lightning ground. Provide an exterior entry point into the CERT by means of one inch conduit.

#### 1.10 CABLE TELEVISION REQUIREMENTS

The television system shall consist of a bridging amplifier, RG-59/U coaxial cables, splitters, 75 oh terminators and "F" type connectors. The outlets shall be self-terminating type "F" connectors suitable for mounting on a recessed outlet box. The splitters and amplifiers shall be located in the CER. The coaxial cable run must be from the CER to each individual outlet location (i.e. home run configuration).

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

## SECTION 01290

KANSAS CITY DISTRICT  
STRUCTURAL DESIGN GUIDANCE  
CONTROLLING CRITERIA

## PART 1 GENERAL

## 1.1 GENERAL

## 1.1.1 Purpose and Scope

Design will be completed in accordance with the criteria and instruction documents furnished for this project. A structural controlling criteria listing is provided below, however, the design engineer shall be responsible for incorporation of all applicable information.

## 1.1.2 Minimum Requirements

The criteria established herein will be used as the minimum standards for structural loading and design. If a local code, which also must be followed for design of the building, is more stringent for a particular criterion, the local code may be used as the minimum requirement for that criterion.

## 1.1.3 Applicability

This structural design controlling criteria is applicable to all projects within the Kansas City District military jurisdiction, or as stated otherwise.

## 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.

## U.S. ARMY CORPS OF ENGINEERS (USACE)

TI 809-01	(Aug 1998) Load Assumptions for Buildings
TI 809-02	(Sep1999) Structural Design Criteria for Buildings
TI 809-04	(Jan 1999) Seismic Design for Buildings
TI 809-07	(Nov 1998) Design of Cold-Formed Load Bearing Steel Systems and Masonry Veneer/Steel Stud Walls
TI 809-29	(Aug 1999) Structural Considerations for Metal Roofing
TI 809-30	(Aug 1998) Metal Building Systems
TI 818-02	(Aug 1998) Design of Deep Foundations

TM 5-809-1 (May 1992) Structural Design Criteria Loads

TM 5-809-3 (Oct 1992) Masonry Structural Design for Buildings

TM 5-809-6 (Dec 1991) Structural Design Criteria for Structures Other than Buildings

TM 5-809-12 (Aug 1987) Concrete Floor Slabs on Grade Subjected to Heavy Loads

TM 5-818-1 (Oct 1983) Soils and Geology Procedures for Foundation Design of Buildings and Other Structures (Except Hydraulic Structures)

TM 5-822-5 (Jun 1992) Pavement Design for Roads, Streets, Walks and Open Storage Areas (Incl C1)

CEGS 03200 (Sep 1997) Concrete Reinforcement

CEGS 03300 (Sep 1995) Cast-In-Place Structural Concrete

CEGS 04200 (Jul 1992) Masonry

CEGS 06100 (Feb 2002) Rough Carpentry

CEGS 07416 (Oct 1998) Structural Standing Seam Metal Roof (SSSMR) System

CEGS 07530 (Sep 1995) Elastomeric Roofing (EPDM)

CEGS 13120 (Sep 1998) Standard Metal Building Systems

CEGS 13121 (Jan 2002) Metal Building Systems (Minor Requirements)

DG 1110-3-107 (Sep 1984) Design Guide for U.S. Army Reserve Facilities

ER 1110-345-700 (May 1997) Design Analysis, Drawings, and Specifications

EM 1110-2-2502 (Sep 1989) Retaining and Flood Walls

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 318-02 (2002) Requirements for Structural Concrete and Commentary

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC "Manual of Steel Construction--Load & Resistance Factor Design" (third Edition)

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-673 (1996) "Cold Formed Steel Design Manual"

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/AF&PANDS (1977) National Design Specification for Wood Construction

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 98 (1998) Minimum Design Loads for Buildings and Other Structures

ASCE ST5 May 1978 Local Effects of Tornado-Generated Missiles, Anil K. Kar, "Journal of the Structural Division"

DEPARTMENT OF DEFENSE (DoD)

DOD 5100.76-M (Sep 2000) DoD 5100.76-M, "Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives", Chapter 3

TR-83 Jul 1975 Wind-Resistant Design Concepts for Residences, Defense Civil Preparedness Agency

METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)

MBMA-01 (2001) Low Rise Building Systems Manual.

NATIONAL CONCRETE MASONRY ASSOCIATION (NCMA)

TEK Publication 12-2 "The Structural Role of Joint Reinforcement in Concrete Masonry"

STEEL DECK INSTITUTE (SDI)

SDI Steel Roof Deck Design Manual (current publication)

STEEL JOIST INSTITUTE (SJI)

SJI Standard Specification, Load Tables and Weight Tables

### 1.3 SELECTION OF STRUCTURAL SYSTEM

#### 1.3.1 Overall

The overall structural system to be used will be based on the cost effectiveness of the system and will take into account both the superstructure and foundation. The comparison of competitive systems will also consider the cost factors related to the architectural, mechanical, electrical and other features that comprise the total building. The goals in the selection of a load resisting system are simplicity in the structural framing layout and symmetry in the structural system reaction to design loadings. The selections must consider the need for economy, function, and reliability. Structural systems selected must have deformation characteristics that are compatible with the architectural and

other nonstructural building elements and features. Regular structure configuration, continuous and redundant load paths, and system ductility are attributes encouraged. These attributes are required of buildings constructed in high seismic areas.

1.3.2 Coordination

The structural engineer shall coordinate with the architect at the inception of the design, and throughout, so that the structural system layout can be properly coordinated with the building architecture to provide the most effective and efficient overall plan.

1.3.3 Minimum

The minimum structural system will be selected from TI 809-02 for wind loads and TI 809-04 for seismic loads. Conform to all applicable /requirements, general and specific, found in TI 809-02 and TI 809-04 for the structural system selected.

1.4 LOADING CRITERIA

1.4.1 General Requirements

1.4.1.1 Dead and Live Loads

For dead and live loads use the latest version of ASCE 7, but no earlier than ASCE 7 98.

1.4.1.2 Snow and Wind Loads

For snow and wind loads use the latest version of ASCE 7, but no earlier than ASCE 7 98, except as modified by TI 809-01. Use Category II to determine the importance factors and use wind exposure C.

1.4.1.3 Seismic Design

For seismic design use TI 809-04. Use Seismic Group I. Use site class and site characteristic information as recommended in the geotechnical subsurface investigation report. Use the following spectral response coefficients for the locations listed below in Table 4-1. Otherwise, use the zip code for the project location and the USGS Zip Code earthquake ground motion hazard look-up page, which can be found on the internet world wide web address <http://geohazards.cr.usgs.gov/eq/>.

Table 4-1

Location	Ss	S1
Ft. Leavenworth, KS	0.13	0.06
Ft. Riley, KS	0.20	0.06
McConnell AFB, KS	0.14	0.06
Ft. LeonardWood, MO	0.27	0.13
Whiteman AFB, MO	0.13	0.08

1.4.1.4 Combined Loads

For combined loads use the latest version of ASCE 7, but no earlier than ASCE 7 98, and TI 809-04 for load combinations that include seismic loads.

1.4.2 Specific Requirements

#### 1.4.2.1 Controlling Forces

If wind loading on the main lateral force resisting system and/or the components and cladding members are greater than seismic loadings and thus are the controlling forces that are used for structural design, the structural seismic detailing requirements given in TI 809-04 must also be used. Both wind and seismic loading for components and cladding must be investigated to determine controlling forces regardless of controlling loads on the main force resisting system.

#### 1.4.2.2 Tributary Area "A"

The tributary area "A" to be used in determining the exterior wind pressure coefficients for components and cladding shall be the actual loaded area of the structural element under consideration and not the entire area of the loading region in which the member resides. However, for rectangular tributary areas, the width need not be assumed to be less than 1/3 of the length of the area.

#### 1.4.2.3 Internal Wind Pressure Coefficients

When determining the internal wind pressure coefficients for buildings, doors and windows shall be assumed opened or closed as required to produce the coefficients that will produce the greatest wind loadings, both inward and outward.

#### 1.4.2.4 Roof Slopes

For roof slopes less than  $\frac{1}{2}$  inch per foot (1:24), include in the design snow load a rain-on-snow surcharge load of 5 psf (0.24 kPa).

#### 1.4.2.5 Design for Roof Snow or Snow Plus Rain-on-Snow

When the design roof snow or snow plus rain-on-snow loading is less than 20 pounds per square foot (0.96 kPa), a roof live loading for construction and maintenance of 20 pounds per square foot (0.96 kPa) shall be used for design of the structure. The minimum roof live load of 20 psf (0.96 kPa) is used in lieu of and not in addition to the snow or rain plus snow loading.

#### 1.4.2.6 Net Inward and Outward Loads

The maximum net inward and outward loads used in the design shall be indicated on the Contract Drawings. The design engineer is responsible for calculating the wind loads based on the applicable paragraph Loading Criteria, Specific Requirements. However, in calculating component and cladding loading, whether or not the SSSMR is applied over a substrate, the smallest acceptable internal pressure coefficient shall be as defined in ASCE 7 95. The component and cladding loads shall be calculated based on the tributary area of a clip; maximum tributary area of 10 square feet (1 square meter).

#### 1.4.2.7 Loading on Railings

For loading on railings, use the latest edition of ASCE 7 (ASCE 7 98), except that the minimum load for one- and two-family dwellings shall be 50 lb/ft (0.29kN/m).

#### 1.4.2.8 Electrically Driven Cranes

For electrically driven cranes, a design check shall be made assuming the live loading on the crane is 2.75 times the rated loading. For this loading case, the allowable material stresses may be 90% of the yield stresses. In lieu of this design check, an electric limit switch may be used.

#### 1.4.2.9 Permanently Installed Cranes

For electrically driven permanently installed cranes support use the impact percentages, horizontal force percentages, and fatigue requirements in the Manual of Steel Construction (AISC publication, current edition).

### 1.5 DESIGN CRITERIA

#### 1.5.1 Foundations

##### 1.5.1.1 Compliance

Comply with the applicable recommendations in the geotechnical subsurface investigation report provided by CENWK-EC-GL.

##### 1.5.1.2 Footing Depth

Minimum footing depth for frost consideration shall be determined using TI 809-01, but not less than 3 feet (915mm). The bottom of all exterior footings shall also meet the recommendations in the geotechnical subsurface investigation report. provided by CENWK-EC-GL.

##### 1.5.1.3 Control Joints

Where control joints are required in concrete foundation walls, they shall be located where control joints are required in CMU walls above the foundations. Control joints in concrete foundations are not required at all control joints in CMU.

##### 1.5.1.4 Reinforcing Bar

In all concrete foundation walls that directly support CMU walls, provide one additional reinforcing bar longitudinally at the top of the concrete wall that is one size greater than the other longitudinal reinforcement. This added bar shall be continuous through all control and construction joints. In all concrete walls with vertical mats of reinforcing in each face, provide two additional bars at the top, one in each face.

##### 1.5.1.5 Masonry Veneer

When masonry veneer is used, the foundation stem wall shall be stepped to form a brick ledge at least 8 inches (200mm) lower than the finished floor.

##### 1.5.1.6 Basement Walls

Basement walls (walls mostly below grade that are supported laterally by diaphragms at or near the top and bottom) shall be designed using loadings based on at rest soil pressures. A design check of basement walls shall be made using submerged earth pressure, the free water surface at grade and surcharge loading if present. For this design check, the allowable stresses for the wall materials may be increased to be 90% of the yield stresses or for strength design, a overall load factor of 1.1 may be used.

#### 1.5.1.7 Retaining Walls

Retaining walls subjected to hydraulic loadings such as flowing water, submergence, wave action, and spray, exposure to chemically contaminated atmosphere, and/or severe climatic conditions, shall be designed using EM 1110-2-2502. Earth retaining walls not subjected to the above mentioned conditions may be designed using TM 5-818-1. A design check of retaining walls shall be made using assumed submerged active earth pressures, free water pressures all around and surcharge loading if present. For this design check, factors of safety for overturning and sliding shall be at least 1.2 and the allowable stresses for all wall materials may be increased to be 90% of the yield stresses or for strength design, a overall load factor of 1.1 may be used.

#### 1.5.1.8 Deep Foundations

For deep foundations, including concrete drilled pier foundations, use TM 5-818-1 and TI 818-02.

#### 1.5.1.9 Loading Docks

Loading docks, if present, shall be designed as retaining walls using at-rest soil values.

#### 1.5.1.10 Structural Stoops

Structural stoops shall be provided at exterior doorways directly adjacent to exterior concrete slabs. Stoops should have foundations to frost depth and should be rigidly attached to foundation walls.

### 1.5.2 Concrete

#### 1.5.2.1 Concrete Design

For concrete design, except for slabs on grade subjected to heavy loads, use TI 809-02, TI 809-04, and ACI 318-95 with the TI's controlling over ACI in cases of conflict. TI 809-04 controls over TI 809-02 in cases of conflict.

#### 1.5.2.2 Keys

Do not use keys in horizontal and vertical concrete construction joints. Specify the use of joints roughened to 1/4 inch (6mm) amplitude per ACI 318-02.

#### 1.5.2.3 Concrete Floor Slabs-on-grade

For concrete floor slabs-on-grade subjected to heavy moving loads, use TM 5-809-12.

#### 1.5.2.4 Post/Rack Loads

For concrete floor slabs-on-grade subjected to post/rack loads, use Designing Floor Slabs on Grade by Boyd C. Ringo and Robert B. Anderson, 1992, chapters 4 and 6 and "Slab Thickness Design for Industrial Concrete Floors on Grade" by Robert C. Packard, Portland Cement Association, 1976 with the latter controlling in cases of conflict.

#### 1.5.2.5 Exterior Concrete Slabs-on-grade

For exterior concrete slabs-on-grade subject to heavy moving loads, use TM 5-822-5.

#### 1.5.2.6 9-inch Walls or Slabs

All walls or slabs greater than 9 inches (230mm) thick shall have two or more layers of reinforcing steel.

### 1.5.3 Masonry

#### 1.5.3.1 CMU/Brick

For masonry design (CMU and/or brick), use TM 5-809-3, and TI 809-04 with TI 809-04 controlling in case of conflict.

#### 1.5.3.2 Masonry Design

All masonry design will be reinforced masonry. These walls shall be designed as reinforced masonry assuming simply supported vertical spans between diaphragms.

#### 1.5.3.3 Exterior Walls

If exterior walls have a CMU wythe available due to economic or architectural reasons, the CMU will be used as the vertical and main lateral force resisting systems in lieu of providing steel frames along these walls.

#### 1.5.3.4 Brick Veneer

Brick veneer with steel stud backup exterior wall systems shall strictly adhere to the criteria and detailing requirements of TI 809-07.

#### 1.5.3.5 CMU Structural and Partition Walls

In buildings with CMU structural and partition walls, all horizontal and vertical block layout dimensions shall be based on coursing using an 8 inch module when using IP units for design and a 200mm module when using hard metric design. This includes all dimensions for openings as well as the total wall.

#### 1.5.3.6 Steel Columns

Steel columns shall not be embedded over all or part of their height in CMU or concrete walls.

#### 1.5.3.7 Single Wythe CMU Walls

Single wythe CMU walls permanently exposed to weather shall be fully grouted.

#### 1.5.3.8 Double Wythe Walls

The preferred method of construction of double wythe walls is that the wythes be brought up together. The specification, section 04200 shall be edited to prohibit the use of adjustable ties, to prohibit the construction of one wythe independent of the other, and to require that the wythes be brought up together.

#### 1.5.3.9 Cavity Width

For double wythe walls, the maximum cavity width shall be 3.5 inches (89 mm) for ladder type joint reinforcement at 16 inches (400 mm) vertical spacing. The maximum cavity width shall be 5 inches (127 mm) for joint reinforcement vertical spacing of 8 inches (200 mm). Reference National Concrete Masonry Association TEK Publication 12-2 "The Structural Role of Joint Reinforcement in Concrete Masonry".

#### 1.5.3.10 Reinforced Load Bearing CMU Walls

In structural reinforced load bearing CMU walls, vertical reinforcing bars shall be hooked into the top horizontal bond beam at the roof level with a standard ACI 90 degree hook for resistance to roof uplift loads.

#### 1.5.3.11 Structural CMU Walls

Structural CMU walls shall be placed in running bond pattern only. Stacked bond pattern for structural walls is not permitted.

#### 1.5.3.12 Thin Brick Veneer

The use of thin brick veneer is not permitted.

### 1.5.4 Structural Steel

#### 1.5.4.1 Structural Steel Design

For structural steel design, use TI 809-04, TI 809-02, and the AISC Manual of Steel Construction, current edition, with the TI's controlling over AISC in cases of conflict. TI 809-04 controls over TI 809-02 in cases of conflict.

#### 1.5.4.2 Structural Steel Resisting Systems

In buildings or other structures where the main vertical or lateral force resisting systems are structural steel, the main force member connections shall not be made by field welding; ie, there shall be no field welded moment connections, no field welded shear tabs, no field welded bracing connections, etc.

#### 1.5.4.3 Structural Steel Columns or Beams

Structural steel columns or beams will not be given lateral support by the bottom chords or the bottom chords of extended open web or long span steel joists or joist girders.

#### 1.5.4.4 Braced Frames

In buildings where braced frames are used as all or part of the main lateral force resisting system, the stability of the structural system shall not depend on any single member or connection. Redundancy shall be provided either by using multiple bays of tension only X-bracing members or by using bracing members that are capable of both tension and compression if bracing is placed in a single bay. The lateral load resisting system shall comply with the redundancy requirements of TI 809-04.

### 1.5.5 Metal Building Systems

#### 1.5.5.1 Metal Building Systems

Metal Building Systems. For metal building systems, previously referred to as pre-engineered metal buildings (PEMB), follow the guidance given in TI 809-30 and the criteria presented in CEGS 13120 and/or CEGS 13121 as applicable. The minimum size in plan of the building along with the required clear distance to the bottom of the structural steel should be shown on the contract plans along with any additional minimum clearance requirements. The minimum sizes of all foundation members, including thickness and reinforcing steel sizes and spacings, should be shown along with the minimum footing depth. The Contract Drawings shall show the vertical, horizontal, and moment loading used to compute the minimum footing sizes in a tabular form with the corresponding resultant footing sizes. The Contractor will be required by the specifications to provide the final design of the foundation, if the loading exceeds that shown on the drawings. All concrete floor slabs on grade will be designed using the applicable criteria contained in the section Design Criteria, Concrete above.

#### 1.5.5.2 Hairpins

If the eave height of the metal building system exceeds 20 feet (6 meters), or the rigid frame span exceeds 60 feet (18 meters), or other considerations require, then hairpins shall not be used. Other methods, such as foundation tie beams or at-rest pressures acting on the foundation elements, shall be used to provide resistance to the horizontal loads acting at the base of the metal building system columns. Passive soil pressures will not be used to resist column thrusts unless sufficient supporting justification (including consideration of soil disturbance, moisture conditions, freezing and thawing, and deflection) is provided. Not more than one-half the full passive soil pressure will be used to resist horizontal thrust from columns.

#### 1.5.5.3 Isolation

The metal building system shall be structurally isolated from other structures (e.g. masonry buildings or arms vaults) located therein.

#### 1.5.5.4 Minimum Sizes of Foundation Members

To determine the minimum sizes of the foundation members, the dead loads of the metal building system columns shall be determined using the different loading combinations of the latest version of ASCE 7 (ASCE 7 98) and a suitable computer program. The resultant footing sizes shall be presented in tabular form in a footing schedule with the corresponding design loads on the contract drawings.

#### 1.5.5.5 Supports

Where the metal building system will be used to support lateral loads from non-structural elements, such as the top of CMU firewalls, these loads shall be provided on the contract drawings.

#### 1.5.5.6 Resisting Lateral Loads

The allowable methods for resisting lateral loads shall be cross-bracing, rigid frames, or wind columns. All braces used in roofs and walls to transfer or resist load, such as wind loads, seismic loads, and crane

thrusts, shall be either standard hot rolled sections or rods. Adjustable rods must be permanently locked in place after final adjustment. Cable bracing is not permitted except for erection purposes.

#### 1.5.5.7 Minimum Lateral Force

The minimum required lateral force resisting system shall be shown on the roof framing plan, to include the minimum number and location of cross braced bays.

#### 1.5.5.8 Base Plate Detail

Provide a typical base plate detail on the drawings and edit the specifications to assure compliance with the following minimum base plate requirements:

- At least two anchor bolts are required for base plates with least dimension equal to or less than 12 inches (305mm) and at least four anchor bolts (one near each corner) are required when the least dimension of the base plate is greater than 12 inches (305mm).
- Show the minimum edge distances from the bolt centerline to the edge of the base plate.
- The base plate shall not bear on the slab-on-grade;
- The base plate shall be grouted with non-shrink grout.
- Show the minimum edge distance from the anchor bolts to the concrete pedestal face. Anchor bolts shall not be less than 3/4 inch (M20) in diameter and shall be confined by at least one #4 (#13) reinforcing bar.

#### 1.5.5.9 SSSMR

When SSSMR is a component of a metal building system, the Corps of Engineer's Guide Specification section CEGS 07416 must be used and coordinated with section CEGS 13120 or CEGS 13121 as applicable.

### 1.5.6 Steel Joists

#### 1.5.6.1 Steel Joist Design

For steel joist design, use Standard Specification, Load Tables and Weight Tables (SDI).

#### 1.5.6.2 Open Web and Long Span Steel Joists

Open web and long span steel joists are designed as laterally supported simple beams under vertical uniform gravity loading. For any other condition, the joist manufacturer must be required to provide the certified design of the joist. The building designer will provide the desired joist depth and spacing along with the required loading diagrams for both upward and downward loadings. The designer will require the manufacturer to select and certify the joist design for the loads specified on the drawings.

#### 1.5.6.3 Sloping Roofs or Floors

Open web steel joists used on sloping roofs or floors that exceed a slope of 1/2 inch vertical on 12 inches horizontal (1:24) shall be designed by

the manufacturer for that slope. The design shall include the effects of axial loads that result from load components acting parallel to the slope.

#### 1.5.6.4 Bottom Chord Extension

The bottom chord of open web steel joists shall not be extended to supporting members except as specifically shown on manufacturer's shop or erection drawings.

#### 1.5.6.5 Suspended Load Support

The bottom chord of open web steel joists shall not be used to support suspended loads.

#### 1.5.6.6 Field Welding

Field welding to the bottom chord of open web steel joist is not permitted, except as expressly permitted in writing by the joist manufacturer.

#### 1.5.7 Decks, Diaphragms, and Light Gage Steel Members

##### 1.5.7.1 General Requirements

For the general requirements for the design and detailing of diaphragms use TI 809-04.

##### 1.5.7.2 Diaphragms

Diaphragms shall have continuous chord members on all edges and shall have direct positive connection for transferring shear load to all members of the main lateral force resisting system.

##### 1.5.7.3 Steel Roof and Floor Deck Design

For steel roof and floor deck design, use Steel Roof Deck Design Manual (SDI ), TI 809-02 and TI 809-04 with TI's controlling the diaphragm design over SDI and TI 809-04 controlling over TI 809-02 in cases of conflict.

##### 1.5.7.4 Screw Connections

All screw connections for diaphragms shall be No. 12 or larger. Weld connections of steel deck shall use E60 electrodes.

##### 1.5.7.5 Cold Formed Members

For cold formed structural steel sheet members, strictly adhere to the design guidance provisions of TI 809-07.

#### 1.5.8 Wood

##### 1.5.8.1 Wood Design and Construction

For wood design and construction, excluding plywood, use National Design Specification for ANSI/AF&PANDS, TI 809-04, and TI 809-02 with the TI 809-02 controlling over NFPA and TI 809-04 controlling over TI 809-02 in cases of conflict.

##### 1.5.8.2 Plywood

For plywood properties and design criteria, use current American Plywood Association published brochures, TI 809-04 and TI 809-02 with the TI controlling for diaphragm flexibility determination along with minimum nailing requirements for diaphragms.

#### 1.5.8.3 Fire-retardant Treated Wood

Fire-retardant treated wood shall not be used for structural applications. This includes, but is not limited to wood trusses, wood framing, and APA rated structural use panels (including plywood). Reference CEGS 06100 for additional information.

#### 1.5.8.4 Non-Vertical Applications

The use of Oriented Strand Board (OSB) for non-vertical applications is not permitted. For floor and roof sheathing, APA structural rated plywood sheathing only shall be used. Specifically, for floors, use as a minimum, 23/32 inch (18mm) thickness APA rated STURD-I-FLOOR, 24 inch (600mm) on center span rating, Exposure 1, Tongue and Groove, glued and nailed. In addition, all of the requirements of the APA "Code Plus Floor" shall be met. Ring- or screw-shank nails shall be used.

#### 1.5.9 Roofing

##### 1.5.9.1 Metal Roofing

Metal Roofing. Metal roofing systems shall conform to the guidance in TI 809-29, with exceptions and revision contained herein.

##### a. Structural Standing Seam Metal Roof (SSSMR) System

Since there is a wide variety in roof system configurations, fastening systems, and accessories, excessive detailing of the roof system will be avoided. For conventionally engineered buildings, the designer will provide details to include all members below the hold-down clip, including subpurlins and their connections, attachment of wood blocking (if used), and restrictions on the use of thermal barriers or blocks as required.

For conventionally engineered buildings, TI 809-02 requires the design engineer to provide loading diagrams on the Contract Documents, including the dimensions of edge, eave, ridge and corner zones. Loads are to be calculated in accordance with ASCE 7 98 using a maximum tributary area of 10 square feet (1 square meter). The tributary is based on a maximum panel width and maximum clip spacing. All tributary areas of 10 square feet (1 square meter) or less have the same external pressure coefficient according to ASCE 7 98 and MBMA-01. The internal pressure coefficient for conventionally engineered buildings and Metal Building Systems shall be determined based on the combination of opened and closed doors and windows which produce the greatest wind loadings. The internal pressure coefficient shall be determined considering large openings, such as aircraft hanger doors, open, unless special provisions are made to assure the openings will be closed at the time of high winds. The minimum internal pressure coefficient per ASCE 7 98 for installations over open or solid substrates shall be used to account for air infiltration and leakage at the eaves. For Metal Building Systems, select the basic wind speed value from TI 809-01. The

importance factor and exposure factors will be obtained from ASCE 7 98. Loading diagrams for metal buildings systems are required to be submitted with the shop drawings.

For conventionally engineered buildings both purlin and subpurlin design are the responsibility of the designer. The designer will incorporate the criteria in the specifications including the changes in the SPECIFICATIONS paragraph in the design of the framing members. Typical roof sections showing the purlins or subpurlins, including minimum gauge, minimum section properties, minimum connection requirements, bracing provisions for the flanges under both positive and negative bending, and maximum allowable purlin or subpurlin spacing shall be shown on the contract drawings.

For buildings utilizing a steel deck as a roof diaphragm, inverting the steel deck to accommodate the subpurlins is not permitted.

Roof slopes less than 1 1/2 inch on 12 (1:8) require mechanical seaming and the specifications must be revised to indicate this requirement.

When the SSSMR is a component of a metal building system, the section CEGS 07416 must be used and coordinated with section CEGS 13120 or CEGS 13121 as applicable.

b. Non-structural applications.

A non-structural standing seam metal roof shall be applied over a solid substrate. The designer is responsible for the design of the substrate. Subpurlins are required if insulation is to be placed above the substrate and shall be shown on the Contract Drawings. Attachment of clips through rigid insulation to structure is prohibited. If the substrate is plywood, the design shall include a nailing pattern shown on the Contract Drawings. If the substrate is a metal deck, the deck must be designed for the full wind load in accordance with the provisions of Load Criteria, Specific Requirements. The metal deck shall be designed for concentrated loads and line loads in addition to the appropriate uniformly distributed load. Clips or subpurlins shall be attached through the metal deck to the structure below with bolts or screws. If the clips or subpurlins are attached to the metal deck alone, then bolts (not less than 1/4 inch (6mm) diameter with locking washers and nuts), blind screw-type expandable fasteners (FAB-LOK fasteners as manufactured by Fabco Fastening Systems, or approved equal), or blind (pop) rivets (9/32 inch (7mm) diameter, BULB-TITE, as manufactured by Olympic Fastening Systems, Inc., or approved equal) must be used.

1.5.9.2 Elastomeric Roofing (EPDM)

a. EPDM roofing shall comply with the criteria CEGS 07530, ELASTOMERIC ROOFING (EPDM). Only the adhesive bonded system will be used. The ballasted system is not permitted. The adhesive bonded system will be used with the following additional requirements.

Require the manufacturer to provide a standard warranty for 10 years.

According to the guide specifications, insulation under adhered membrane must be attached to the substrate with mechanical fasteners or steep (Type III) insulation. The guide specifications also require that on steel decks, or any slope exceeding 1/2 inch per foot, the first layer of insulation shall be mechanically fastened. For multiple layers of insulation, the preferred practice is to mechanically fasten the bottom board and then adhere the upper boards to lower boards with steep asphalt or an approved adhesive. Mechanical fasteners must be capable of resisting the uplift roof pressures shown on the contract drawings, with appropriate factors of safety for the fasteners and substrate provided. The minimum factor of safety for fasteners is three.

Require the roofing manufacturer to furnish a certified wind uplift test, Factory Mutual, I-90 rating, for the roofing assembly. An I-90 rating -presently the highest Factory Mutual rating - is given when a load of 90 psf is reached and maintained for 1 minute. The minimum factor of safety for this system is two. This means that the membrane is considered suitable to sustain a maximum design load of 45 psf with a safety factor of two. There will be many cases where the uplift pressures shown on the wind uplift load diagram on the contract drawings will exceed 45 psf at corners and edges. If the design uplift values exceed 45 psf for the adhesive bonded system, the shortcomings of this type of roofing system shall be reported to the customer. If the customer considers it reasonable to accept the risk of failure and will be responsible to repair the damage as it occurs, then this roofing system may be used where design uplift exceeds 45 psf. If the customer decides that full resistance to design uplift above 45 psf must be provided, another roofing system shall be .

The contract drawings must include a wind uplift diagram based on criteria from TM 5-809-1/AFM 88-3, Chap. 1, for the entire roof, including the high pressure areas along the edges and corners. A load tributary area of 10 square feet or less should be used in determining wind load coefficients.

Special attention must be given to the shop approval and evaluation of material to assure that unacceptable materials and systems are not installed. The system shall comply in all respects with the roof assemblies as described in the Factory Mutual Approval Guide. This includes insulation type, fastener types and quantities, and adhesives.

#### 1.5.9.3 Flat Roofs

Flat roofs shall have a secondary drainage system.

#### 1.5.10 Architectural, Mechanical, and Electrical Equipment

##### 1.5.10.1 Anchorage and/or Isolation Requirements

For anchorage and/or isolation requirements for architectural, mechanical and electrical elements, use TI 809-04.

##### 1.5.10.2 Underground Storage Tanks

For underground storage tanks, the anchorage slabs and tank restraints shall be designed assuming the tanks are empty and the free water surface is at the finished earth grade. The factor of safety of the gravity loads over the buoyant forces shall be at least 1.5.

#### 1.5.11 Special Structures and Conditions

##### 1.5.11.1 Structures Other than Buildings

For structures other than buildings, use TM 5-809-6.

##### 1.5.11.2 Arms Vaults

For Arms Vaults, use DOD 5100.76-M, Chapter 3, except for Arms Vaults located in USARC project. In that case, use Design Guide DG 1110-3-107, dated Sep 84.

##### 1.5.11.3 Tornado Shelters

For Tornado Shelters, use TR-83, Wind-Resistant Design Concepts for Residences, Defense Civil Preparedness Agency, July 1975, including TR-83A, Interim Guidelines for Building Occupant Protection from Tornadoes and Extreme Winds. Also use Local Effects of Tornado-Generated Missiles, Anil K. Kar, Journal of the Structural Division, ASCE ST5, May 1978.

##### 1.5.11.4 Expansion Bolt Anchors

The use of expansion bolt anchors for connections between the elements of the main lateral force resisting structural system is not permitted.

##### 1.5.11.5 Rack Storage Design

a. The racks shall be designed in accordance with the latest version of the Uniform Building Code. The design and construction of the racks and rack components shall meet requirements to resist vertical and lateral seismic forces.

b. Minimum rack requirements for each different storage rack configuration shall be shown on the Contract Drawings. This includes the minimum post base plate size and the anchorage requirements. The A-E is responsible for assuring that the post load assumptions made in designing the slab are not exceeded by the post loads of the actual rack configuration.

c. The specifications shall include the minimum acceptable material requirements, load capacity, factor of safety, and submittal requirements for each type of rack storage unit required.

#### 1.6 DESIGN ANALYSIS

The Design Analysis Structural Chapter shall be prepared in accordance with ER 1110-345-700 and shall include, as a minimum, the following.

##### 1.6.1 Structural Systems

The structural system shall be selected from the approved systems listed in TI 809-02. A general description of the structural system for the building and/or truck loading docks including seismic considerations should be given with reasons for selection of the system used and including cost

comparisons. Structural system examples include: (1) a building frame system with load bearing and shear walls and interior steel columns supporting steel girders and joists; (2) a moment resisting steel rigid frame system supporting steel beams and joists; (3) a moment resisting concrete frame system with reinforced concrete beams, columns and pan joists; (4) a bearing wall system with reinforced masonry exterior and interior vertical and lateral load bearing walls with steel joists spanning between walls and supporting a flexible steel deck diaphragm.

#### 1.6.2 Roof and Floor System

General method of framing and type of deck including options. Cost comparisons shall be furnished to justify system selected. Address the type, span to depth ratios and classification of the diaphragm. Address features which impact the layout of the structural framing, such as standing seam metal roofing.

#### 1.6.3 Walls and Partitions

Describe composition and general range of thicknesses, seismic design when used, method of providing lateral support for the partitions, and location of load bearing and shear walls.

#### 1.6.4 Foundation System

Foundation design data or assumptions and description of type of foundation system to be used for the buildings and truck loading docks.

#### 1.6.5 Design Loads

Roof and floor live loads, wind and seismic lateral loads, and unusual dead loads should be given. Truck loads for the design of the truck loading docks.

#### 1.6.6 Design Data

A listing of material properties for all materials to be used in the project, including allowable soil properties (with source notation).

#### 1.6.7 Unusual Design Features

Those which might be controversial should be clearly presented in such a manner that definite approval can be given.

#### 1.6.8 Site Adaptation

When site adapting standard working drawings or designs used at other locations, the data required herein should be limited to design changes resulting from loading, climatic and soil conditions at the new site and/or updating for conformance to current criteria.

#### 1.6.9 Criteria

List criteria needed to complete final design.

#### 1.6.10 Calculations

Calculations done using computer programs or spreadsheets shall include sufficient documentation to verify input and output, accuracy of theory,

and accuracy of computations.

## 1.7 CONTRACT DRAWINGS

### 1.7.1 General Notes

The drawings shall contain in the General Notes a list of the design loading criteria, a list of the strengths of the engineering materials used, the design soil values and any other data that would be pertinent to remodeling and/or future additions. Also, a description of the building structural system shall be given so that the construction contractor will know when the building is self supporting.

### 1.7.2 Detailing

The detailing of structural steel framing, including connections, shall be complete. All weld types, weld sizes, bolting layouts, bolt sizes, connection plates and members sizes and locations and stiffener plates sizes and locations shall be shown. Elevations of steel frames used in the lateral load resisting system shall be shown on the contract drawings.

### 1.7.3 Elevations of Masonry Walls

Elevations of all masonry walls showing all openings, lintels, bond beams, horizontal and vertical reinforcement and control joints shall be shown on the structural drawings, including horizontal and vertical dimensions of wall panels, openings, etc. Elevations shall indicate all portions of the masonry wall that are piers or columns as defined in TI 809-04, and indicate the required details. The minimum scale for masonry wall elevations shall be  $\frac{1}{4}$ " = 1'-0" (1:50 for metric jobs).

### 1.7.4 Force Resisting System Detailing

All members, elements and connections that are a part of the main vertical and/or lateral force resisting system must be completely detailed.

### 1.7.5 Joint Locations

Show locations of control joints for slab-on-grade floors. Show locations of brick expansion joints.

### 1.7.6 Joist Loading Diagrams

The required joist loading diagrams for both upward and downward loading, computed in accordance with the Loading Criteria General Requirements and Specific Requirements paragraphs, must be shown on the Contract Drawings.

### 1.7.7 Roofing Criteria

See Section Design Criteria, Roofing, in this appendix for standing seam metal roofing loading diagram requirements and minimum detailing requirements.

## 1.8 SPECIFICATIONS

### 1.8.1 Methods and Products

Proprietary materials, fabricated products or construction methods cannot be used. At least three manufacturers must be known before any product can

be shown or specified.

#### 1.8.2 Paragraph Replacement

Replace paragraph 1.2 SUBMITTALS, SD-04 Drawings given in section CEGS 03200 with the following:

"Complete shop drawings shall be submitted. The shop drawings shall be prepared under the direct supervision of a licensed professional engineer. The shop drawings shall contain his seal and a statement certifying that they are in compliance with the specifications and contract drawings. The shop drawing shall include details of the bending and placing schedule of the steel reinforcement, together with bar schedules indicating the number, size, dimensions, and total length of various bars required. Bar lists and bending diagrams shall be checked for accuracy and completeness before the bars are fabricated. Details of typical supports for reinforcing steel shall be approved prior to placing any concrete. Shop drawings shall show all concrete dimensions, location of all reinforcement, elevations, reinforcing steel clearances, and the location of all construction joints shown on the drawings or proposed by the Contractor. The drawings shall show support details including types, sizes and spacing. Spacing between vertical reinforcing steel shall be shown on the wall elevations. The minimum scale used in the shop drawings shall be 3/8-inch to the foot (1:50). Reinforcement bending details shall conform to the requirements of ACI SP-66."

#### 1.8.3 Concrete for Buildings

Concrete for buildings shall comply with the CEGS 03300 dated September 1995 including changes through Notice 3 (February 1999) with the exception of subparagraph 1.3.4 Slump and paragraphs 1.4 PROPORTIONS OF MIX, 2.1 ADMIXTURES, 2.2 CEMENTITIOUS MATERIAL, 2.3 AGGREGATE, 3.3 BATCHING, MIXING AND TRANSPORTING CONCRETE, and 3.4 SAMPLING AND TESTING. Specific information for these paragraphs shall be obtained from CENWK-EC-GL for incorporation into the CEGS 03300 format. A Government mix design is required for the concrete used in all projects. Any project specific requirements which would necessitate changes in the mix design, examples of which include, but are not limited to drilled piers, industrial and other special application floor slabs, multicubical munition structures, and high strength concrete applications, shall be discussed with CENWK-EC-GL. It is the designer's responsibility to bring the need for required changes in the mix design to the attention of both CENWK-EC-GL and CENWK-EC-DS. The results of these discussions, including any deviations from the preceding requirements shall be documented and included in the design analysis.

#### 1.8.4 Masonry

Masonry shall comply with current version of CEGS 04200, but dated no earlier than July 1992 including changes through Notice 12 (Jun 1999). This specification includes mortar proportion requirements to reduce efflorescence. The specification, section CEGS 04200 shall be edited to prohibit the use of adjustable ties, to prohibit the construction of one wythe independent of the other, and to require that the wythes be brought up together in all seismic zones.

#### 1.8.5 Standing Seam Roofing System

The standing seam roofing system shall comply with the current version of section CEGS 07416, but dated no earlier than October 1998 including changes through Notice 2 (Sep 1999), with the exceptions noted below. Earlier versions of the specification are not to be used, if the version of the specification you are editing does not match this number, notify CENWK.

#### 1.8.5.1 Added Paragraph

Add the subparagraph 1.2.4 Manufacturer's Representative to read "A representative of the SSSMR manufacturer, who is familiar with the design of the roof system supplied and experienced in the erection of roof systems similar in size to the one required under this contract, shall be present at the job site during installation of the SSSMR to assure that the roof system meets specified requirements. The manufacturer's representative shall be either an employee of the manufacturer with at least two years experience in installing the roof system or an employee of an independent installer that is certified by the SSSMR manufacturer to have two years of experience in installing similar roof systems."

#### 1.8.5.2 Revised Note

Revise Note following Paragraph 1.3 Design Requirements as follows: In the first sentence, change the wording "...and these paragraphs will be coordinated accordingly." to "...and these paragraphs will be deleted."

#### 1.8.5.3 Revised Sentence

Revise first sentence in subparagraph 1.3.5 Wind Loads to read, "The design uplift pressures for the roof system shall be [as indicated on the contract drawings.] [computed and applied using a basic wind speed of \_\_\_\_\_ miles per hour (fastest mile), and importance factor of \_\_\_\_\_, and exposure factor of \_\_\_\_\_, an internal pressure coefficient of \_\_\_\_\_, and a tributary area of 10 square feet]."

The uplift pressures shall be computed by the design engineer and shown on the drawings for conventional designed structures. For metal building systems, the manufacturer must compute the uplift pressures using the parameters provided by the design engineer.

#### 1.8.5.4 Revised Subparagraph

Change the subparagraph 1.3.7 Framing Members Supporting the SSSMR System to read, "[Structural cold-formed steel framing members and their connections, including minimum required connection capacity shall be as shown on the contract drawings.] [Structural cold-formed steel framing members and their connections shall be designed in accordance with AISI SG-673. Maximum deflections under applied dead and live load and/or wind load for subpurlins shall not exceed 1/180 times the span length and shall be based on constraint conditions at the supports. Subpurlins shall be designed to span from structural member to structural member. Attachment to a metal deck, if present, is permitted for lateral stability only. Subpurlins must be adequately braced for both positive and negative bending. Subpurlins are required at all clip locations in installations above a metal deck. Attaching clips through rigid insulation to structure is prohibited.]"

#### 1.8.5.5 Revised Paragraph

From the subparagraph 1.3.8 Roof Panels Design, revise next to last sentence to read "Deflections shall be based on panels being continuous

across three or more supports, fastener spacing, and the ability of the panel to rotate freely on the support."

#### 1.8.5.6 Revised Subparagraph

Add the following to the end of subparagraph 1.3.9 Accessories and Their Fasteners, "The design uplift force for the accessory connections and the factors of safety, shall be as required in subparagraph 1.3.5 Wind Loads."

#### 1.8.5.7 Added Paragraph

Add paragraph 1.4.1 to read as follows:

"1.4.1 Concealed Anchor Clip Connection to Building Structure  
The tested capacity of fasteners used to connect the concealed anchor clips to [subpurlins] [structural purlins] [metal roof deck] [plywood sheathing] shall be determined from tests supplied by the fastener manufacturer or an independent testing laboratory. Tests shall be performed on fasteners and supporting members that are made from the same materials and are equal or less in size and thickness to the fasteners and supporting members used in the actual roof installation. The maximum uplift loading used in the test shall be the design uplift force multiplied by the factor of safety. The design uplift force and the factors of safety shall be as required in subparagraph 1.3.5 Wind Loads."

#### 1.8.5.8 Added Paragraph

Add paragraph 1.4.2 to read as follows:

"[1.4.2 Subpurlin Connection to Building Structure  
The tested capacity of fasteners used to connect the subpurlins [to structural purlins] [through metal roof deck to building structure] [to plywood sheathing] shall be determined from tests supplied by the fastener manufacturer or an independent testing laboratory. Tests shall be performed on fasteners and supporting members that are made from the same materials and are equal or less in size and thickness to the fasteners and supporting members used in the actual roof installation. The maximum uplift loading used in the test shall be the design uplift force [given on the drawings for the roof area under consideration] multiplied by the factor of safety. The factors of safety [and the design uplift force] shall be as required in subparagraph 1.3.5 Wind Loads.]"

#### 1.8.5.9 Revised Subparagraph

Change sub paragraph SD-01 Data to read,

"Design Analysis; [\_\_\_\_\_].

Design analysis signed by a Registered Professional Engineer, and submitted for approval prior to beginning of manufacture. The design analysis shall include, but not be limited to the following information:

- a. A list of the design loads.
- b. Thermal movements that will result from the specified temperature range. The calculations shall be accompanied by details from the manufacturer that demonstrate how installed concealed anchor clips and other roof system devices will accommodate the required thermal movement.
- c. Concentrated load and roof live load analysis.
- [d. Subpurlin catalog cuts, section property information and sketches to

indicate that the subpurlin geometry has been coordinated with the metal deck configuration and that the subpurlins will nest properly in the metal deck flutes.]

\*\*\*\*\*  
NOTE: The following submittal requirements apply to metal building systems only.  
\*\*\*\*\*

[d. Complete calculations of the support system [,including purlins and/or subpurlins designed in accordance with subparagraph: Framing Members].]

[e. Wind forces on various parts of the roof. Both positive and negative pressures shall be calculated based on the criteria in subparagraph: Design Conditions and parameters in subparagraph: Wind Uplift Loads. The resultant wind uplift forces and dimensions of the edge and corner zones will be shown on an isometric view of the roof.]"

1.8.5.10 Revised Paragraph

Add the following to the end of paragraph SD-04, Drawings to the end of the paragraph: "The shop drawings shall also include the SSSMR component details that resulted from the design calculations and the wind uplift testing required herein. The shop drawings also shall show the locations and configuration of any thermal spacer blocks or barriers. Subpurlin layouts shall be shown [and the spacing must be coordinated with the metal deck configuration, lap locations, and sidelap configurations]."

1.8.5.11 Added Items

Add the following items to the end of paragraph SD-09 Reports to read,

i. Fastener Test Report (Additional Requirement)- Manufacturer's test report or independent test laboratory report. Tests shall be performed on fasteners and supporting members that are made from the same materials and are equal or less in size and thickness to the fasteners and supporting members used in the actual roof installation.

j. Panel Finish Color (Additional Requirement)- Test results shall be submitted for all roofing panels showing the results of testing in accordance with the color finish tests specified in paragraphs 2.6.1 through 2.6.8.

1.8.5.12 Revised Paragraph

Change paragraph SD-14 Samples to include submittal of external clamps or clips used by the manufacturer to increase the load capacity of the roof system. This paragraph must be coordinated with the user of the facility to assure that there is no architectural requirement to limit the use of external clamps.

"External attachments; [\_\_\_\_\_].

External attachment- two samples of every type of permanent external attachment either, clips or clamps, used in the tested system to increase the rated capacity of the roofing system."

1.8.5.13 Revised Subparagraph

Revise the second sentence of subparagraph 2.1.1 Steel Panels to read, "Uncoated panels shall be 0.024-inch (0.61 mm) thick minimum, except that areas of the roof subject to design wind uplift pressures of 60 psf (2.87 kPa) or greater shall have a minimum panel thickness of 0.030-inch (0.76 mm)."

1.8.5.14 Addition to Subparagraph

Add the following to the end of subparagraph 2.3 ACCESSORIES "Thermal spacer blocks and other thermal barriers shall be submitted for approval."

1.8.5.15 Revised Subparagraph

Change the first sentence of subparagraph 2.4.1 Screws to read, "Screws for attaching anchor devices shall be not less than No. 14 self-tapping type and not less than No. 12 if self-drilling and self-tapping type."

1.8.5.16 Revised Paragraph

Replace the first sentence of 2.5 SUBPURLINS to read, " Cold formed subpurlins [, when required by the system design,] shall be formed from steel sheet as standard with the manufacturer. The uncoated thickness [shall be as shown on the contract drawings. The subpurlins shall meet the minimum properties shown on the contract drawings [, with the flange configuration designed and coordinated to nest properly in the flutes of the metal deck.]] [may be a minimum of 0.059-inches (1.50 mm) if bolts or structural blind fasteners are used for attachment of the concealed anchor clips to the subpurlins and attachment of the subpurlins to the structure. If screws are used for either attachment, then the minimum uncoated thickness of the subpurlin shall be 0.074-inches (1.85 mm).] Cold formed subpurlins shall have a minimum tensile yield strength of 50,000 psi (345 MPa)."

1.8.5.17 Addition to Subparagraph

Add to end of subparagraph 3.1.2 Subpurlins "Closer spacing may be required by the roofing manufacturer to meet the roof uplift loads [shown on the contract drawings] [calculated and submitted with the shop drawings.]"

1.8.5.18 Revised Subparagraph

Replace the first sentence of subparagraph 3.1.4 Concealed Anchor Clips to read, "Roof panels shall be fastened to framing members with concealed fastening clips or other concealed devices. Clips shall be attached directly to the building structural system or to the subpurlins with bolts or screws."

1.8.5.19 Addition to Subparagraph

Add to the end of subparagraph 3.1.4 Concealed Anchor Clips to read, "Closer spacing may be required by the roofing manufacturer to meet the roof uplift pressures [shown on the contract drawings] [calculated and submitted with the shop drawings.] Attachment of clips through rigid insulation to structure is prohibited."

1.8.5.20 Addition to Subparagraph

Add the following to the end of subparagraph 3.2.1 Board Insulation with Blanket Insulation and to subparagraph Blanket Insulation 3.2.2, "Thermal

blocks shall not be placed in between the concealed anchor clips and the subpurlins or supporting structure."

PART 2 PRODUCTS

PART 3 EXECUTION

-- End of Section --

## SECTION 01312A

QUALITY CONTROL SYSTEM (QCS)  
08/01

## PART 1 GENERAL

## 1.1 GENERAL INFORMATION

The Government will use the Resident Management System for Windows (RMS) to assist in its monitoring and administration of this contract. The Contractor shall use the Government-furnished Construction Contractor Module of RMS, referred to as QCS, to record, maintain, and submit various information throughout the contract period. This joint Government-Contractor use of RMS and QCS will facilitate electronic exchange of information and overall management of the contract. QCS provides the means for the Contractor to input, track, and electronically share information with the Government in the following areas:

- Administration
- Finances
- Quality Control
- Submittal Monitoring
- Scheduling
- Import/Export of Data

## 1.1.1 Correspondence and Electronic Communications

For ease and speed of communications, both Government and Contractor will, to the maximum extent feasible, exchange correspondence and other documents in electronic format. Correspondence, pay requests and other documents comprising the official contract record shall also be provided in paper format, with signatures and dates where necessary. Paper documents will govern, in the event of discrepancy with the electronic version.

## 1.1.2 Other Factors

Particular attention is directed to Contract Clause, "Schedules for Construction Contracts", Contract Clause, "Payments", Section 01320A, PROJECT SCHEDULE, Section 01330, SUBMITTAL PROCEDURES, and Section 01451A, CONTRACTOR QUALITY CONTROL, which have a direct relationship to the reporting to be accomplished through QCS. Also, there is no separate payment for establishing and maintaining the QCS database; all costs associated therewith shall be included in the contract pricing for the work.

## 1.2 QCS SOFTWARE

QCS is a Windows-based program that can be run on a stand-alone personal computer or on a network. The Government will make available the QCS software to the Contractor after award of the construction contract. Prior to the Pre-Construction Conference, the Contractor shall be responsible to download, install and use the latest version of the QCS software from the Government's RMS Internet Website. Upon specific justification and request by the Contractor, the Government can provide QCS on high-density diskettes or CD-ROM. Any program updates of QCS will be made available to the Contractor via the Government RMS Website as they become available.

### 1.3 SYSTEM REQUIREMENTS

The following listed hardware and software is the minimum system configuration that the Contractor shall have to run QCS:

#### **Hardware**

IBM-compatible PC with 200 MHz Pentium or higher processor

32+ MB RAM

4 GB hard drive disk space for sole use by the QCS system

3 1/2 inch high-density floppy drive

Compact disk (CD) Reader

Color monitor

Laser printer compatible with HP LaserJet III or better, with minimum 4 MB installed memory.

Connection to the Internet, minimum 28 BPS

#### **Software**

MS Windows 95 or newer version operating system (MS Windows NT 4.0 or newer is recommended)

Word Processing software compatible with MS Word 97 or newer

Internet browser

The Contractor's computer system shall be protected by virus protection software that is regularly upgraded with all issued manufacturer's updates throughout the life of the contract.

Electronic mail (E-mail) compatible with MS Outlook

### 1.4 RELATED INFORMATION

#### 1.4.1 QCS User Guide

After contract award, the Contractor shall download instructions for the installation and use of QCS from the Government RMS Internet Website; the Contractor can obtain the current address from the Government. In case of justifiable difficulties, the Government will provide the Contractor with a CD-ROM containing these instructions.

#### 1.4.2 Contractor Quality Control(CQC) Training

The use of QCS will be discussed with the Contractor's QC System Manager during the mandatory CQC Training class.

### 1.5 CONTRACT DATABASE

Prior to the pre-construction conference, the Government shall provide the Contractor with basic contract award data to use for QCS. The Government

will provide data updates to the Contractor as needed, generally by files attached to E-mail. These updates will generally consist of submittal reviews, correspondence status, QA comments, and other administrative and QA data.

## 1.6 DATABASE MAINTENANCE

The Contractor shall establish, maintain, and update data for the contract in the QCS database throughout the duration of the contract. The Contractor shall establish and maintain the QCS database at the Contractor's site office. Data updates to the Government shall be submitted by E-mail with file attachments, e.g., daily reports, schedule updates, payment requests. If permitted by the Contracting Officer, a data diskette or CD-ROM may be used instead of E-mail (see Paragraph DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM). The QCS database typically shall include current data on the following items:

### 1.6.1 Administration

#### 1.6.1.1 Contractor Information

The database shall contain the Contractor's name, address, telephone numbers, management staff, and other required items. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver Contractor administrative data in electronic format via E-mail.

#### 1.6.1.2 Subcontractor Information

The database shall contain the name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor must be listed separately for each trade to be performed. Each subcontractor/trade shall be assigned a unique Responsibility Code, provided in QCS. Within 14 calendar days of receipt of QCS software from the Government, the Contractor shall deliver subcontractor administrative data in electronic format via E-mail.

#### 1.6.1.3 Correspondence

All Contractor correspondence to the Government shall be identified with a serial number. Correspondence initiated by the Contractor's site office shall be prefixed with "S". Letters initiated by the Contractor's home (main) office shall be prefixed with "H". Letters shall be numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C".

#### 1.6.1.4 Equipment

The Contractor's QCS database shall contain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates.

#### 1.6.1.5 Management Reporting

QCS includes a number of reports that Contractor management can use to track the status of the project. The value of these reports is reflective of the quality of the data input, and is maintained in the various sections of QCS. Among these reports are: Progress Payment Request worksheet, QA/QC comments, Submittal Register Status, Three-Phase Inspection checklists.

## 1.6.2 Finances

### 1.6.2.1 Pay Activity Data

The QCS database shall include a list of pay activities that the Contractor shall develop in conjunction with the construction schedule. The sum of all pay activities shall be equal to the total contract amount, including modifications. Pay activities shall be grouped by Contract Line Item Number (CLIN), and the sum of the activities shall equal the amount of each CLIN. The total of all CLINs equals the Contract Amount.

### 1.6.2.2 Payment Requests

All progress payment requests shall be prepared using QCS. The Contractor shall complete the payment request worksheet and include it with the payment request. The work completed under the contract, measured as percent or as specific quantities, shall be updated at least monthly. After the update, the Contractor shall generate a payment request report using QCS. The Contractor shall submit the payment requests with supporting data by E-mail with file attachment(s). If permitted by the Contracting Officer, a data diskette may be used instead of E-mail. A signed paper copy of the approved payment request is also required, which shall govern in the event of discrepancy with the electronic version.

## 1.6.3 Quality Control (QC)

QCS provides a means to track implementation of the 3-phase QC Control System, prepare daily reports, identify and track deficiencies, document progress of work, and support other contractor QC requirements. The Contractor shall maintain this data on a daily basis. Entered data will automatically output to the QCS generated daily report. The Contractor shall provide the Government a Contractor Quality Control (CQC) Plan within the time required in Section 01451A, CONTRACTOR QUALITY CONTROL. Within seven calendar days of Government acceptance, the Contractor shall submit a data diskette or CD-ROM reflecting the information contained in the accepted CQC Plan: schedule, pay activities, features of work, submittal register, QC requirements, and equipment list.

### 1.6.3.1 Daily Contractor Quality Control (CQC) Reports.

QCS includes the means to produce the Daily CQC Report. The Contractor may use other formats to record basic QC data. However, the Daily CQC Report generated by QCS shall be the Contractor's official report. Data from any supplemental reports by the Contractor shall be summarized and consolidated onto the QCS-generated Daily CQC Report. Daily CQC Reports shall be submitted as required by Section 01451A, CONTRACTOR QUALITY CONTROL. Reports shall be submitted electronically to the Government using E-mail or diskette within 24 hours after the date covered by the report. Use of either mode of submittal shall be coordinated with the Government representative. The Contractor shall also provide the Government a signed, printed copy of the daily CQC report.

### 1.6.3.2 Deficiency Tracking.

The Contractor shall use QCS to track deficiencies. Deficiencies identified by the Contractor will be numerically tracked using QC punch list items. The Contractor shall maintain a current log of its QC punch list items in the QCS database. The Government will log the deficiencies it has identified using its QA punch list items. The Government's QA punch

list items will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of both QC and QA punch list items.

#### 1.6.3.3 Three-Phase Control Meetings

The Contractor shall maintain scheduled and actual dates and times of preparatory and initial control meetings in QCS.

#### 1.6.3.4 Accident/Safety Tracking.

The Government will issue safety comments, directions, or guidance whenever safety deficiencies are observed. The Government's safety comments will be included in its export file to the Contractor. The Contractor shall regularly update the correction status of the safety comments. In addition, the Contractor shall utilize QCS to advise the Government of any accidents occurring on the jobsite. This brief supplemental entry is not to be considered as a substitute for completion of mandatory reports, e.g., ENG Form 3394 and OSHA Form 200.

#### 1.6.3.5 Features of Work

The Contractor shall include a complete list of the features of work in the QCS database. A feature of work may be associated with multiple pay activities. However, each pay activity (see subparagraph "Pay Activity Data" of paragraph "Finances") will only be linked to a single feature of work.

#### 1.6.3.6 QC Requirements

The Contractor shall develop and maintain a complete list of QC testing, transferred and installed property, and user training requirements in QCS. The Contractor shall update all data on these QC requirements as work progresses, and shall promptly provide this information to the Government via QCS.

#### 1.6.4 Submittal Management

The Government will provide the initial submittal register, ENG Form 4288, SUBMITTAL REGISTER, in electronic format. Thereafter, the Contractor shall maintain a complete list of all submittals, including completion of all data columns. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall use QCS to track and transmit all submittals. ENG Form 4025, submittal transmittal form, and the submittal register update, ENG Form 4288, shall be produced using QCS. RMS will be used to update, store and exchange submittal registers and transmittals, but will not be used for storage of actual submittals.

#### 1.6.5 Schedule

The Contractor shall develop a construction schedule consisting of pay activities, in accordance with Contract Clause "Schedules for Construction Contracts", or Section 01320A, PROJECT SCHEDULE, as applicable. This schedule shall be input and maintained in the QCS database either manually or by using the Standard Data Exchange Format (SDEF) (see Section 01320A PROJECT SCHEDULE). The updated schedule data shall be included with each pay request submitted by the Contractor.

#### 1.6.6 Import/Export of Data

QCS includes the ability to export Contractor data to the Government and to import submittal register and other Government-provided data, and schedule data using SDEF.

#### 1.7 IMPLEMENTATION

Contractor use of QCS as described in the preceding paragraphs is mandatory. The Contractor shall ensure that sufficient resources are available to maintain its QCS database, and to provide the Government with regular database updates. QCS shall be an integral part of the Contractor's management of quality control.

#### 1.8 DATA SUBMISSION VIA COMPUTER DISKETTE OR CD-ROM

The Government-preferred method for Contractor's submission of updates, payment requests, correspondence and other data is by E-mail with file attachment(s). For locations where this is not feasible, the Contracting Officer may permit use of computer diskettes or CD-ROM for data transfer. Data on the disks or CDs shall be exported using the QCS built-in export function. If used, diskettes and CD-ROMs will be submitted in accordance with the following:

##### 1.8.1 File Medium

The Contractor shall submit required data on 3-1/2 inch double-sided high-density diskettes formatted to hold 1.44 MB of data, capable of running under Microsoft Windows 95 or newer. Alternatively, CD-ROMs may be used. They shall conform to industry standards used in the United States. All data shall be provided in English.

##### 1.8.2 Disk or CD-ROM Labels

The Contractor shall affix a permanent exterior label to each diskette and CD-ROM submitted. The label shall indicate in English, the QCS file name, full contract number, contract name, project location, data date, name and telephone number of person responsible for the data.

##### 1.8.3 File Names

The Government will provide the file names to be used by the Contractor with the QCS software.

#### 1.9 MONTHLY COORDINATION MEETING

The Contractor shall update the QCS database each workday. At least monthly, the Contractor shall generate and submit an export file to the Government with schedule update and progress payment request. As required in Contract Clause "Payments", at least one week prior to submittal, the Contractor shall meet with the Government representative to review the planned progress payment data submission for errors and omissions. The Contractor shall make all required corrections prior to Government acceptance of the export file and progress payment request. Payment requests accompanied by incomplete or incorrect data submittals will be returned. The Government will not process progress payments until an acceptable QCS export file is received.

#### 1.10 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the requirements of this specification. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification.

-- End of Section --

## SECTION 01320A

PROJECT SCHEDULE  
08/01

## PART 1 GENERAL

## 1.1 REFERENCES

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

## U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1-1-11 (1995) Progress, Schedules, and Network Analysis Systems

## 1.2 QUALIFICATIONS

The Contractor shall designate an authorized representative who shall be responsible for the preparation of all required project schedule reports.

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

## 3.1 GENERAL REQUIREMENTS

Pursuant to the Contract Clause, SCHEDULE FOR CONSTRUCTION CONTRACTS, a Project Schedule as described below shall be prepared. The scheduling of construction shall be 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. The approved Project Schedule shall be used to measure the progress of the work, to aid in evaluating time extensions, and to provide the basis of all progress payments.

## 3.2 BASIS FOR PAYMENT

The schedule shall be the basis for measuring Contractor progress. Lack of an approved schedule or scheduling personnel will result in an inability of the Contracting Officer to evaluate Contractor's progress for the purposes of payment. Failure of the Contractor to provide all information, as specified below, shall result in the disapproval of the entire Project Schedule submission and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. In the case where Project Schedule revisions have been directed by the Contracting Officer and those revisions have not been included in the Project Schedule, the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until revisions to the Project Schedule have been made.

## 3.3 PROJECT SCHEDULE

The computer software system utilized by the Contractor to produce the

Project Schedule shall be capable of providing all requirements of this specification. Failure of the Contractor to meet the requirements of this specification shall result in the disapproval of the schedule. Manual methods used to produce any required information shall require approval by the Contracting Officer.

### 3.3.1 Use of the Critical Path Method

The Critical Path Method (CPM) of network calculation shall be used to generate the Project Schedule. The Contractor shall provide the Project Schedule in the Precedence Diagram Method (PDM).

### 3.3.2 Level of Detail Required

The Project Schedule shall include an appropriate level of detail. Failure to develop or update the Project Schedule or provide data to the Contracting Officer at the appropriate level of detail, as specified by the Contracting Officer, shall result in the disapproval of the schedule. The Contracting Officer will use, but is not limited to, the following conditions to determine the appropriate level of detail to be used in the Project Schedule:

#### 3.3.2.1 Activity Durations

Contractor submissions shall follow the direction of the Contracting Officer regarding reasonable activity durations. Reasonable durations are those that allow the progress of activities to be accurately determined between payment periods (usually less than 2 percent of all non-procurement activities' Original Durations are greater than 20 days).

#### 3.3.2.2 Procurement Activities

Tasks related to the procurement of long lead materials or equipment shall be included as separate activities in the project schedule. Long lead materials and equipment are those materials that have a procurement cycle of over 90 days. Examples of procurement process activities include, but are not limited to: submittals, approvals, procurement, fabrication, and delivery.

#### 3.3.2.3 Critical Activities

The following activities shall be listed as separate line activities on the Contractor's project schedule:

- a. Submission and approval of mechanical/electrical layout drawings.
- b. Submission and approval of O & M manuals.
- c. Submission and approval of as-built drawings.
- d. Submission and approval of 1354 data and installed equipment lists.
- e. Submission and approval of testing and air balance (TAB).
- f. Submission of TAB specialist design review report.
- g. Submission and approval of fire protection specialist.
- h. Submission and approval of testing and balancing of HVAC plus

commissioning plans and data.

- i. Air and water balance dates.
- j. HVAC commissioning dates.
- k. Controls testing plan.
- l. Controls testing.
- m. Performance Verification testing.
- n. Other systems testing, if required.
- o. Prefinal inspection.
- p. Correction of punchlist from prefinal inspection.
- q. Final inspection.

#### 3.3.2.4 Government Activities

Government and other agency activities that could impact progress shall be shown. 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.

#### 3.3.2.5 Responsibility

All activities shall be identified in the project schedule by the party responsible to perform the work. Responsibility includes, but is not limited to, the subcontracting firm, contractor work force, or government agency performing a given task. Activities shall not belong to more than one responsible party. The responsible party for each activity shall be identified by the Responsibility Code.

#### 3.3.2.6 Work Areas

All activities shall be identified in the project schedule by the work area in which the activity occurs. Activities shall not be allowed to cover more than one work area. The work area of each activity shall be identified by the Work Area Code.

#### 3.3.2.7 Modification or Claim Number

Any activity that is added or changed by contract modification or used to justify claimed time shall be identified by a mod or claim code that changed the activity. Activities shall not belong to more than one modification or claim item. The modification or claim number of each activity shall be identified by the Mod or Claim Number. Whenever possible, changes shall be added to the schedule by adding new activities. Existing activities shall not normally be changed to reflect modifications.

#### 3.3.2.8 Bid Item

All activities shall be identified in the project schedule by the Bid Item to which the activity belongs. An activity shall not contain work in more than one bid item. The bid item for each appropriate activity shall be identified by the Bid Item Code.

### 3.3.2.9 Phase of Work

All activities shall be identified in the project schedule by the phases of work in which the activity occurs. Activities shall not contain work in more than one phase of work. The project phase of each activity shall be by the unique Phase of Work Code.

### 3.3.2.10 Category of Work

All Activities shall be identified in the project schedule according to the category of work which best describes the activity. Category of work refers, but is not limited, to the procurement chain of activities including such items as submittals, approvals, procurement, fabrication, delivery, installation, start-up, and testing. The category of work for each activity shall be identified by the Category of Work Code.

### 3.3.2.11 Feature of Work

All activities shall be identified in the project schedule according to the feature of work to which the activity belongs. Feature of work refers, but is not limited to, a work breakdown structure for the project. The feature of work for each activity shall be identified by the Feature of Work Code.

## 3.3.3 Scheduled Project Completion

The schedule interval shall extend from NTP to the contract completion date.

### 3.3.3.1 Project Start Date

The schedule shall start no earlier than the date on which the NTP was acknowledged. The Contractor shall include as the first activity in the project schedule an activity called "Start Project". The "Start Project" activity shall have an "ES" constraint date equal to the date that the NTP was acknowledged, and a zero day duration.

### 3.3.3.2 Constraint of Last Activity

Completion of the last activity in the schedule shall be constrained by the contract completion date. Calculation on project updates shall be such that if the early finish of the last activity falls after the contract completion date, then the float calculation shall reflect a negative float on the critical path. The Contractor shall include as the last activity in the project schedule an activity called "End Project". The "End Project" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

### 3.3.3.3 Early Project Completion

In the event the project schedule shows completion of the project prior to the contract completion date, the Contractor shall identify those activities that have been accelerated and/or those activities that are scheduled in parallel to support the Contractor's "early" completion. Contractor shall specifically address each of the activities noted in the narrative report at every project schedule update period to assist the Contracting Officer in evaluating the Contractor's ability to actually complete prior to the contract period.

## 3.3.4 Interim Completion Dates

Contractually specified interim completion dates shall also be constrained to show negative float if the early finish date of the last activity in that phase falls after the interim completion date.

#### 3.3.4.1 Start Phase

The Contractor shall include as the first activity for a project phase an activity called "Start Phase X" where "X" refers to the phase of work. The "Start Phase X" activity shall have an "ES" constraint date equal to the date on which the NTP was acknowledged, and a zero day duration.

#### 3.3.4.2 End Phase

The Contractor shall include as the last activity in a project phase an activity called "End Phase X" where "X" refers to the phase of work. The "End Phase X" activity shall have an "LF" constraint date equal to the completion date for the project, and a zero day duration.

#### 3.3.4.3 Phase X

The Contractor shall include a hammock type activity for each project phase called "Phase X" where "X" refers to the phase of work. The "Phase X" activity shall be logically tied to the earliest and latest activities in the phase.

#### 3.3.5 Default Progress Data Disallowed

Actual Start and Finish dates shall not be automatically updated by default mechanisms that may be included in CPM scheduling software systems. Actual Start and Finish dates on the CPM schedule shall match those dates provided from Contractor Quality Control Reports. Failure of the Contractor to document the Actual Start and Finish dates on the Daily Quality Control report for every in-progress or completed activity, and failure to ensure that the data contained on the Daily Quality Control reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes. Updating of the percent complete and the remaining duration of any activity shall be independent functions. Program features which calculate one of these parameters from the other shall be disabled.

#### 3.3.6 Out-of-Sequence Progress

Activities that have posted progress without all preceding logic being satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case approval of the Contracting Officer. The Contractor shall propose logic corrections to eliminate all out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule.

#### 3.3.7 Negative Lags

Lag durations contained in the project schedule shall not have a negative value.

#### 3.4 PROJECT SCHEDULE SUBMISSIONS

The Contractor shall provide the submissions as described below. The data

disk, reports, and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS.

#### 3.4.1 Preliminary Project Schedule Submission

The Preliminary Project Schedule, defining the Contractor's planned operations for the first 60 calendar days shall be submitted for approval within 20 calendar days after the NTP is acknowledged. The approved preliminary schedule shall be used for payment purposes not to exceed 60 calendar days after NTP.

#### 3.4.2 Initial Project Schedule Submission

The Initial Project Schedule shall be submitted for approval within 40 calendar days after NTP. The schedule shall provide a reasonable sequence of activities which represent work through the entire project and shall be at a reasonable level of detail.

#### 3.4.3 Periodic Schedule Updates

Based on the result of progress meetings, specified in "Periodic Progress Meetings," the Contractor shall submit periodic schedule updates. These submissions shall 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 judgement 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.

#### 3.4.4 Standard Activity Coding Dictionary

The Contractor shall use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11, Appendix A. This exact structure is mandatory, even if some fields are not used.

### 3.5 SUBMISSION REQUIREMENTS

The following items shall be submitted by the Contractor for the preliminary submission, initial submission, and every periodic project schedule update throughout the life of the project:

#### 3.5.1 Data Disks

Two data disks containing the project schedule shall be provided. Data on the disks shall adhere to the SDEF format specified in ER 1-1-11, Appendix A.

##### 3.5.1.1 File Medium

Required data shall be submitted on 3.5 disks, formatted to hold 1.44 MB of data, under the MS-DOS Version 5. or 6.x, unless otherwise approved by the Contracting Officer.

##### 3.5.1.2 Disk Label

A permanent exterior label shall be affixed to each disk submitted. The label shall indicate the type of schedule (Preliminary, Initial, Update, or Change), full contract number, project name, project location, data date, name and telephone number or person responsible for the schedule, and the

MS-DOS version used to format the disk.

#### 3.5.1.3 File Name

Each file submitted shall have a name related to either the schedule data date, project name, or contract number. The Contractor shall develop a naming convention that will ensure that the names of the files submitted are unique. The Contractor shall submit the file naming convention to the Contracting Officer for approval.

#### 3.5.2 Narrative Report

A Narrative Report shall be provided with the preliminary, initial, and each update of the project schedule. This report shall be provided as the basis of the Contractor's progress payment request. The Narrative Report shall include: a description of activities along the 2 most critical paths, 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 relay 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.

#### 3.5.3 Approved Changes Verification

Only project schedule changes that have been previously approved by the Contracting Officer shall be included in the schedule submission. 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.

#### 3.5.4 Schedule Reports

The format for each activity for the schedule reports listed below 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 and Actual Finish Dates shall be printed for those activities in progress or completed.

##### 3.5.4.1 Activity Report

A list of all activities sorted according to activity number.

##### 3.5.4.2 Logic Report

A list of Preceding and Succeeding activities for every activity in ascending order by activity number. Preceding and succeeding activities shall include all information listed above in paragraph Schedule Reports. A blank line shall be left between each activity grouping.

##### 3.5.4.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. Activities which have the same amount of total float shall be listed in ascending order of Early Start Dates. Completed activities shall not be shown on this report.

##### 3.5.4.4 Earnings Report

A compilation of the Contractor's Total Earnings on the project from the NTP until the most recent Monthly Progress Meeting. This report shall reflect the Earnings of specific activities based on the agreements made in the field and approved between the Contractor and Contracting Officer at the most recent Monthly Progress Meeting. Provided that the Contractor has provided a complete schedule update, this report shall serve as the basis of determining Contractor Payment. Activities shall be grouped by bid item and sorted by activity numbers. This report shall: sum all activities in a bid item and provide a bid item percent; and complete and sum all bid items to provide a total project percent complete. The printed report shall contain, for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Total Quantity, Quantity to Date, Percent Complete (based on cost), and Earnings to Date.

### 3.5.5 Network Diagram

The network diagram shall be required on the initial schedule submission and on monthly schedule update submissions. 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:

#### 3.5.5.1 Continuous Flow

Diagrams shall show a continuous flow from left to right with no arrows from right to left. The activity number, description, duration, and estimated earned value shall be shown on the diagram.

#### 3.5.5.2 Project Milestone Dates

Dates shall be shown on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

#### 3.5.5.3 Critical Path

The critical path shall be clearly shown.

#### 3.5.5.4 Banding

Activities shall be grouped to assist in the understanding of the activity sequence. Typically, this flow will group activities by category of work, work area and/or responsibility.

#### 3.5.5.5 S-Curves

Earnings curves showing projected early and late earnings and earnings to date.

### 3.6 PERIODIC PROGRESS MEETINGS

Progress meetings to discuss payment shall include a monthly onsite meeting or other regular intervals mutually agreed to at the preconstruction conference. During this meeting the Contractor shall describe, on an activity by activity basis, all proposed revisions and adjustments to the project schedule required to reflect the current status of the project. The Contracting Officer will approve activity progress, proposed revisions, and adjustments as appropriate.

### 3.6.1 Meeting Attendance

The Contractor's Project Manager and Scheduler shall attend the regular progress meeting.

### 3.6.2 Update Submission Following Progress Meeting

A complete update of the project schedule containing all approved progress, revisions, and adjustments, based on the regular progress meeting, shall be submitted not later than 4 working days after the monthly progress meeting.

### 3.6.3 Progress Meeting Contents

Update information, including Actual Start Dates, Actual Finish Dates, Remaining Durations, and Cost-to-Date shall be subject to the approval of the Contracting Officer. As a minimum, the Contractor shall address the following items on an activity by activity basis during each progress meeting.

#### 3.6.3.1 Start and Finish Dates

The Actual Start and Actual Finish dates for each activity currently in-progress or completed .

#### 3.6.3.2 Time Completion

The estimated Remaining Duration for each activity in-progress. Time-based progress calculations shall be based on Remaining Duration for each activity.

#### 3.6.3.3 Cost Completion

The earnings for each activity started. Payment will be based on earnings for each in-progress or completed activity. Payment for individual activities will not be made for work that contains quality defects. A portion of the overall project amount may be retained based on delays of activities.

#### 3.6.3.4 Logic Changes

All logic changes pertaining to NTP on change orders, change orders to be incorporated into the schedule, contractor proposed changes in work sequence, corrections to schedule logic for out-of-sequence progress, lag durations, and other changes that have been made pursuant to contract provisions shall be specifically identified and discussed.

#### 3.6.3.5 Other Changes

Other changes required due to delays in completion of any activity or group of activities include: 1) delays beyond the Contractor's control, such as strikes and unusual weather. 2) delays encountered due to submittals, Government Activities, deliveries or work stoppages which make re-planning the work necessary. 3) Changes required to correct a schedule which does not represent the actual or planned prosecution and progress of the work.

### 3.7 REQUESTS FOR TIME EXTENSIONS

In the event the Contractor requests an extension of the contract completion date, or any interim milestone date, the Contractor shall

furnish the following for a determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract: justification, project schedule data, and supporting evidence as the Contracting Officer may deem necessary. Submission of proof of delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is obligatory to any approvals.

### 3.7.1 Justification of Delay

The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with this request.

The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in the extension of the schedule, will not be a cause for a time extension to the contract completion date.

### 3.7.2 Submission Requirements

The Contractor shall submit a justification for each request for a change in the contract completion date of under 2 weeks based upon the most recent schedule update at the time of the NTP or constructive direction issued for the change. Such a request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

- a. A list of affected activities, with their associated project schedule activity number.
- b. A brief explanation of the causes of the change.
- c. An analysis of the overall impact of the changes proposed.
- d. A sub-network of the affected area.

Activities impacted in each justification for change shall be identified by a unique activity code contained in the required data file.

### 3.7.3 Additional Submission Requirements

For any requested time extension of over 2 weeks, the Contracting Officer may request an interim update with revised activities for a specific change request. The Contractor shall provide this disk within 4 days of the Contracting Officer's request.

## 3.8 DIRECTED CHANGES

If the NTP is issued for changes prior to settlement of price and/or time, the Contractor shall submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The proposed revisions to the schedule will be approved by the Contracting Officer prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor with suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until revisions are submitted, and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, the Contractor shall advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless

of the objections, the Contractor shall continue to update the schedule with the Contracting Officer's revisions until a mutual agreement in the revisions is reached. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work.

3.9 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 01330

SUBMITTAL PROCEDURES  
09/00

PART 1 GENERAL

1.1 SUBMITTAL IDENTIFICATION

Submittals required are identified by SD numbers and titles as follows:

- SD-01 Preconstruction Submittals
- SD-02 Shop Drawings
- SD-03 Product Data
- SD-04 Samples
- SD-05 Design Data
- SD-06 Test Reports
- SD-07 Certificates
- SD-08 Manufacturer's Instructions
- SD-09 Manufacturer's Field Reports
- SD-10 Operation and Maintenance Data
- SD-11 Closeout Submittals

1.2 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.2.1 Government Approved

Government approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.2.2 Information Only

All submittals not requiring Government approval will contain no reviewer classification on the submittal register, and will be for information only. These information only submittals shall be sent directly to the appropriate Area/Resident Engineer's office.

1.3 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory.

Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. 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.

#### 1.4 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. **Caution:** The Contractor is cautioned that for each Contractor's resubmittal required beyond the initial submittal and one resubmittal for corrections required by the Contracting Officer, the Contracting Officer will assess Administrative Deduction in the amount of \$500.00 from the progress payments due the Contractor. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

#### 1.5 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

### PART 2 PRODUCTS (Not used)

### PART 3 EXECUTION

#### 3.1 GENERAL

The Contractor shall make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control (CQC) System Manager and each item shall be stamped, signed, and dated by the CQC System Manager indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

#### 3.2 SUBMITTAL REGISTER

At the end of this section is a submittal register showing items of

equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals may be required. The Contractor shall complete and submit the forms to the Contracting Officer for approval within twenty (20) calendar days after the Notice to Proceed. The Contractor shall maintain a submittal register for the project in accordance with Section 01312 RESIDENT MANAGEMENT SYSTEM (RMS).

### 3.3 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of thirty (30) calendar days exclusive of mailing time) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals.

### 3.4 TRANSMITTAL FORM (ENG FORM 4025)

The sample transmittal form (ENG Form 4025) attached to this section shall be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

### 3.5 SUBMITTAL PROCEDURE

Submittals shall be made as follows:

#### 3.5.1 Procedures

The Contractor shall submit for approval five (5) copies of all submittals.

For all Military projects an additional copy of all submittals (for information only) related to fire protection/detection systems shall be submitted to the Base Civil Engineering Office for review by the Fire Chief. The mailing address for these submittals shall be obtained at the preconstruction conference. Items not to be submitted in quintuplicate, such as samples and test cylinders, shall be submitted accompanied by five (5) copies of ENG Form 4025. Items to be sent to the Engineering and Construction Division (EC) shall be sent to EC-DS, addressed as follows, where distribution will be made to the appropriate reviewer:

US Army Engineer District, Kansas City  
ATTN: EC-DS (Shop Drawing Coordinator)  
Federal Building, 601 East 12th Street  
Kansas City, Missouri 64106-2896

#### 3.5.2 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

### 3.6 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

### 3.7 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. 4 copies of the submittal will be retained by the Contracting Officer and 2 copies of the submittal will be returned to the Contractor.

### 3.8 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

### 3.9 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACTOR

(Firm Name)

\_\_\_\_\_ Approved

\_\_\_\_\_ Approved with corrections as noted on submittal data and/or attached sheets(s).

SIGNATURE: \_\_\_\_\_

TITLE: \_\_\_\_\_

DATE: \_\_\_\_\_

-- End of Section --



## INSTRUCTIONS

1. Section I will be initiated by the Contractor in the required number of copies.
2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; on resubmittals, insert transmittal number of last submission as well as the new submittal number.
3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288-R for each entry on this form.
4. Submittals requiring expeditious handling will be submitted on a separate form.
5. Separate transmittal form will be used for submittals under separate sections of the specifications.
6. A check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications--also, a written statement to that effect shall be included in the space provided for "Remarks".
7. Form is self-transmittal, letter of transmittal is not required.
8. When a sample of material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I.
9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I, column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g, to each item submitted.

### THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

- |   |   |
|---|---|
| A -- Approved as submitted.   | E -- Disapproved (See attached).  |
| B -- Approved, except as noted on drawings.   | F -- Receipt acknowledged.  |
| C -- Approved, except as noted on drawings.<br>Refer to attached sheet resubmission required. | FX -- Receipt acknowledged, does not comply<br>as noted with contract requirements. |
| D -- Will be returned by separate correspondence.   | G -- Other ( <i>Specify</i> )   |

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

# SUBMITTAL REGISTER

CONTRACT NO.

Ray

TITLE AND LOCATION

McConnell AFB Corrosion Control Phase I

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					REMARKS	
						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)
		01780A	SD-02 Shop Drawings														
			As-Built Drawings	1.2.1	G RE												
			SD-03 Product Data														
			As-Built Record of Equipment and Materials	1.2.2	G RE												
			Warranty Management Plan	1.3.1	G RE												
			Warranty Tags	1.3.5	G RE												
			Final Cleaning	1.6	G RE												
			Filter Fabric	2.2													
			GA-RE														
			Pipe for Subdrains	2.1													
			Filter Fabric	2.2													
			FIO-RE														
			Pipe for Subdrains	2.1													
		02700	SD-08 Manufacturer's Instructions														
			Testing Laboratory, para. 1.6.1														
			GA-RE														
			Equipment, para. 2.3														
			GA-KC														
			Mixing Plant, para. 2.4														
			SD-09 Manufacturer's Field Reports														
			Composition of Mixture, para.'s 2.2 thru 2.2.3.1														
			GA-KC														
			Coarse Aggregate, para. 1.4.2.1.a														

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ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	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)
		02700	Fine Aggregate, para. 1.4.2.1.b														
			Mineral Filler, para. 1.4.2.1.c														
			Aggregate Gradation, para. 1.4.2.2.a														
			Crushed Particle Test, para. 1.4.2.2.b														
			Specific Gravity Test, para. 1.4.2.2.c														
			Bituminous Material, para. 1.5 GA-KC														
		02714	SD-09 Manufacturer's Field Reports														
			Sampling and Testing FIO-RE	1.7													
			Approval of Materials GA, EC-GD	1.7.5													
			Evaluation GA-RE	3.1.7													
		02721	SD-01 Preconstruction Submittals														
			Equipment FIO-RE	1.6													
			SD-08 Manufacturer's Instructions														
			Material Source GA-RE														
			SD-09 Manufacturer's Field Reports														

# SUBMITTAL REGISTER

CONTRACT NO.

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McConnell AFB Corrosion Control Phase I

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ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
						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	DATE RCD FRM APPR AUTH
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
	02721		Sampling and Testing GA-KC	1.4													
	02721a		SD-03 Product Data Equipment [ ], [ ]	1.7													
			Waybills and Delivery Tickets SD-06 Test Reports Sampling and Testing [ ], [ ]	1.3.3 1.5													
	02722		SD-01 Preconstruction Submittals Equipment FIO-RE SD-08 Manufacturer's Instructions Material Source GA-KC SD-09 Manufacturer's Field Reports Sampling and Testing Sampling and Testing GA-KC														
	02722a		SD-03 Product Data Plant, Equipment, and Tools [ ], [ ] Waybills and Delivery Tickets SD-06 Test Reports Sampling and testing	1.7 1.5													

# SUBMITTAL REGISTER

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TITLE AND LOCATION

McConnell AFB Corrosion Control Phase I

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ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					REMARKS	
						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)
		02722a	[ ], [ ] Field Density Tests	1.5.2.4													
		02748	SD-09 Manufacturer's Field Reports Tests GA-RE														
		02748A	SD-03 Product Data Waybills and Delivery Tickets G, FM-RI-MC SD-06 Test Reports Sampling and Testing G, FM-RI-MC														
		02753	SD-01 Preconstruction Submittals Equipment GA-RE Work Plan GA-KC SD-08 Manufacturer's Instructions Samples for Mixture Proportioning Studies GA-KC SD-09 Manufacturer's Field Reports Sampling and Testing GA-KC	1.10													

# SUBMITTAL REGISTER

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ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					REMARKS	
						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)
		02753	Delivery, Storage, and Handling of Materials FIO-RE	1.9													
		02760	SD-06 Test Reports Manufacturer's Recommendations FIO RE														
			SD-07 Certificates Construction Equipment List FIO RE														
			Sealant and Back-up Materials GA RE														
		02763	SD-01 Preconstruction Submittals Equipment Lists GA-RE														
			SD-06 Test Reports Mixing, Thinning and Application GA-RE														
			SD-08 Manufacturer's Instructions Qualifications														
			SD-09 Manufacturer's Field Reports Material Tests GA-RE														
			Volatile Organic Compound (VOC) Content GA-RE														

# SUBMITTAL REGISTER

CONTRACT NO.

Ray

TITLE AND LOCATION

McConnell AFB Corrosion Control Phase I

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					REMARKS	
						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)
		06410a	SD-02 Shop Drawings														
			Shop Drawings	1.5	G AE												
			Shop Drawings	1.8	G AE												
			Installation	3.1	G AE												
			SD-03 Product Data														
			Wood Materials	2.1	G AE												
			Wood Finishes	2.9	G AE												
			Finish Schedule	2.10.7.3	G AE												
			SD-04 Samples														
			Plastic Laminates	2.3	G AE												
			Cabinet Hardware	2.6	G AE												
			SD-07 Certificates														
			Quality Assurance	1.4	G AE												
			Laminate Clad Casework	2.9	G AE												
			Laminate Clad Casework	3.1	G AE												
		07416a	SD-02 Shop Drawings														
			Structural Standing Seam Metal Roof System Drawings		G [ ]												
			SD-03 Product Data														
			Design Analysis		G [ ]												
			Qualifications														
			[ ], [ ]														
			SD-04 Samples														
			Accessories	2.3													
			[ ], [ ]														

# SUBMITTAL REGISTER

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ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	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)
		07416a	Roof Panels	2.1													
			Factory Color Finish	2.6													
			Fasteners	2.4													
			Insulation	2.7													
			Gaskets and Insulating Compounds	2.10													
			Sealant	2.9													
			Concealed Anchor Clips	2.2													
			Subpurlins	2.5													
			EPDM Rubber Boots	2.12													
			External Attachments;														
			SD-06 Test Reports														
			Test Report for Uplift Resistance of the SSSMR		G [ ]												
			SD-07 Certificates														
			Structural Standing Seam Metal Roof System														
			[ ], [ ]														
			Insulation	2.7													
		09310A	SD-02 Shop Drawings														
			Floor and Wall Patterns														
			AE														
			SD-03 Product Data														
			Tile	2.1													
			Tile	2.1													
			AE														

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TITLE AND LOCATION

McConnell AFB Corrosion Control Phase I

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				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	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)
		09310A	Mortar, Grout, and Adhesive														
			Mortar and Grout	3.3.2													
			SD-04 Samples														
			Tile	2.1													
			AE														
			Accessories	2.8													
			SD-07 Certificates														
			Tile	2.1													
			FIO														
			Mortar, Grout, and Adhesive														
		09671	SD-02 Shop Drawings														
			Resin-Based Flooring System														
			AE														
			SD-04 Samples														
			Resin-Based Flooring System														
			AE														
			SD-05 Design Data														
			Resinous Flooring System														
			AE														
			SD-06 Test Reports														
			Testing														
			AE														
			SD-07 Certificates														
			Resin-Based Flooring System														
			AE														
		09672	SD-01 Preconstruction Submittals														

# SUBMITTAL REGISTER

CONTRACT NO.

Ray

TITLE AND LOCATION

McConnell AFB Corrosion Control Phase I

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					REMARKS	
						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)
		09672	Resinous Flooring System AE														
			SD-09 Manufacturer's Field Reports Testing AE														
			Resin-Based Flooring System Resin-Based Flooring System AE														
			Color board		G EC (												
		10100A	SD-01 Preconstruction Submittals														
			Display Track System AE	2.2.1													
			Projection Screens Enclosed Notice Board Case TV Monitor Yoke Mount Unit	2.2.3 2.2.2 2.2.4													
			SD-04 Samples														
			Display Track System AE	2.2.1													
			Projection Screens Enclosed Notice Board Case TV Monitor Yoke Mount Unit	2.2.3 2.2.2 2.2.4													
			SD-06 Test Reports														
			Display Track System Projection Screens Enclosed Notice Board Case	2.2.1 2.2.3 2.2.2													

# SUBMITTAL REGISTER

CONTRACT NO.

Ray

TITLE AND LOCATION

McConnell AFB Corrosion Control Phase I

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	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
		10100A	TV Monitor Yoke Mount Unit	2.2.4													
			Display track system	2.2.1													
			AE														
			Enclosed Notice Board Case	2.2.2													
		10500	SD-01 Preconstruction Submittals														
			Manufacturer's data														
			AE														
			SD-04 Samples														
			Drawings														
			AE														
			Manufacturer's finishes														
			AE														
		11601N	SD-02 Shop Drawings														
			layout	1.4.2	G ED												
			equipment and hood	1.4.3													
			SD-03 Product Data														
			Fumehood assembly		G												
			Radio isotope fumehood		G												
			Biological safety cabinet		G												
			SD-04 Samples														
			Exterior hood paint	1.4.1	G												
			SD-06 Test Reports														
			Fumehood test	1.4.3	G												
			cabinet test	1.4.3	G												
			SD-08 Manufacturer's Instructions														
			Fumehood assembly														

# SUBMITTAL REGISTER

CONTRACT NO.

Ray

TITLE AND LOCATION

McCConnell AFB Corrosion Control Phase I

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					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		MAILED TO CONTR/ DATE RCD FRM APPR AUTH		
																		(g)	(h)
		11601N	Radio isotope fumehood Biological safety cabinet SD-10 Operation and Maintenance Data Fumehood assembly Radio isotope fumehood Biological safety cabinet		G G G														
		12690	SD-01 Preconstruction Submittals Finishes AE Accessory Items SD-04 Samples Entrance Mats AE Finishes AE																
		12705	SD-02 Shop Drawings Approved Detail Drawings AE Installation SD-03 Product Data Installation Instructions Warranty AE Workstation Components SD-04 Samples	3.1   3.1 1.7															

# SUBMITTAL REGISTER

CONTRACT NO.

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TITLE AND LOCATION

McCConnell AFB Corrosion Control Phase I

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
						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	DATE RCD FRM APPR AUTH
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		12705	Workstations														
			AE														
			SD-06 Test Reports														
			Selected Components	2.1.1													
			AE														
			Panel Acoustics	2.1.2													
			Fire Safety	2.1.3													
			Electrical System	2.1.5													
			SD-07 Certificates														
			Workstations														
			AE														
			SD-10 Operation and Maintenance														
			Data														
			Product Assembly Manual														
			Product Maintenance Manuals														
			Cleaning	3.2													
			Electrical System	2.1.5													
		13219N	SD-03 Product Data														
			Cleaning agents	2.1.1													
			Gasoline-oil-resisting rubber gloves and boots	2.2													
			Cotton coveralls and hard hat	2.2													
			Respiratory protective equipment	2.2													
			Disinfectant	2.2													
			Abrasive for blasting	2.1.2.1													
			SD-06 Test Reports														

**SUBMITTAL REGISTER**

CONTRACT NO.

Ray

TITLE AND LOCATION

McCConnell AFB Corrosion Control Phase I

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY					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		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)
		13219N	Blasting abrasive	1.4.12.1													
			Tank contents	1.4.12.1													
			Monitoring Results	1.4.12.2	G												
			SD-07 Certificates														
			Qualifications of Marine Chemist	1.4.11.1													
			Qualifications of Certified Industrial Hygienist (CIH)	1.4.11.2													
			Testing laboratory	1.4.11.3													
			Safety plan	1.4.11.4													
			Work plan	1.4.11.5													
			Hazardous waste disposal plan	1.4.11.6													
			Tank certification of safety	1.4.11.7													
			Plan for pretreatment	3.6.8	G												
			Training certification	1.4.11.4													
			Respiratory protective equipment	2.2													
			Breathing-air supply source	2.2													
			Combustible gas indicator	2.2													
			Lead-in-air analyzer	2.2													
			Hydrogen-sulfide (H2S) indicator	2.2													
			Benzene indicator	2.2													
			Oxygen meter	2.2													
			Velometers	2.2													
			Lighting	2.2													
			First aid kit	2.2													
			exhaust	1.6.1													
			SD-08 Manufacturer's Instructions														



## SECTION 01332

SUBMITTAL PROCEDURES FOR CONSTRUCTION (DESIGN-BUILD)  
02/02

## PART 1 GENERAL

## 1.1 SUBMITTAL DEFINITIONS

The submittals described below are those required and further described in other sections of the specifications. Submittals required by the CONTRACT CLAUSES and other nontechnical parts of the contract are not included in this section.

Submittals required are identified by SD numbers and titles as follows:

SD-01 Preconstruction Submittals

SD-02 Shop Drawings

SD-03 Product Data/Manufacturers' Instructions

SD-04 Samples

SD-05 Design Data

SD-06 Test Reports

SD-07 Certificates

SD-10 Operation and Maintenance Data

## 1.2 SUBMITTAL CLASSIFICATION

## 1.2.1 Government Approved Construction Submittals

Government approval is required for any deviations from the Solicitation or Accepted Proposal and other items as designated by the Contracting Officer's Representative. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

## 1.2.2 Government Reviewed Extension of Design

Government review is required for extension of design construction submittals, used to define contract conformity, and for deviation from the completed design. Review will be only for conformance with the contract requirements. Included are only those construction submittals for which the Designer of Record design documents do not include enough detail to ascertain contract compliance. Government review is not required for extensions of design such as structural steel or reinforcement shop drawings.

## 1.2.3 Information Only

All submittals not for Government approval will be For Information Only (FIO). They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

### 1.3 GOVERNMENT REVIEWED OR "APPROVED" SUBMITTALS

The Contracting Officer's Representative (COR) conformance review or approval of submittals shall not be construed as a complete check, but will indicate only that the design, general method of construction, materials, detailing and other information appear to meet the Solicitation and Accepted Proposal. Government Review or approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Design and CQC requirements of this contract is responsible for design, dimensions, all design extensions, such as the design of adequate connections and details, etc., and the satisfactory construction of all work. After submittals have been reviewed for conformance or approved, as applicable, by the COR, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

### 1.4 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the COR, obtain the Designer of Record's approval, when applicable, and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. Any "Information Only" submittal found to contain errors or unapproved deviations from the Solicitation or Accepted Proposal shall be resubmitted as one requiring "approval" action, requiring both Designer of Record and Government approval. CAUTION: The Contractor is cautioned that for each Contractor's resubmittal required beyond the initial submittal and one resubmittal for corrections required by the Contracting Officer, the Contracting Officer will assess Administrative Deduction in the amount of \$500.00 from the progress payments due the Contractor. If the Contractor considers any correction indicated by the Government on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the COR.

### 1.5 WITHHOLDING OF PAYMENT

No payment for materials incorporated in the work will be made if all required Designer of Record or required Government approvals have not been obtained. No payment will be made for any materials incorporated into the work for any conformance review submittals or Information Only submittals found to contain errors or deviations from the Solicitation or Accepted Proposal.

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

### 3.1 GENERAL

The Contractor shall make submittals as required by the Specifications. The COR may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, the Contractor's

Quality Control (CQC) representative, and the Designer of Record, as applicable, above shall check, approve and stamp, sign, and date each item, indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts, or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

### 3.2 SUBMITTAL REGISTER (ENG FORM 4288)

The Contractor's Designer(s) of Record shall develop a complete list submittals during design. The Designer of Record shall identify required submittals in the specifications. The list is to be used in preparing ENG Form 4288 Submittal Register or a computerized equivalent. The list is not all inclusive and additional submittals may be required by other parts of the contract. The contractor is required to complete ENG Form 4288 (including columns "a" through 'Y') and submit to the Contracting Officer for approval within 30 calendar days after Notice to Proceed. The approved submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period. The submit dates and need dates used in the submittal register shall be coordinated with dates in the Contractor-prepared progress schedule. Updates to the submittal register showing the contractor action codes and actual dates with government action codes and actual dates shall be submitted monthly or until all submittals have been satisfactorily completed. When the progress schedule is revised, the submittal register shall also be revised and both submitted for approval.

### 3.3 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time. (a minimum of thirty (30) calendar days exclusive of mailing time) shall be allowed and shown on the register for Government review or approval. No delay damages or time extensions will be allowed for time lost in late submittals.

### 3.4 TRANSMITTAL FORM (ENG FORM 4025)

The sample transmittal form (ENG Form 4025) attached to this section shall be for transmitting both Government-approved and Information Only submittals in accordance with the instructions on the reverse side of the form. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

### 3.5 SUBMITTAL PROCEDURE

Submittals will be made as follows:

### 3.5.1 Procedures

The Contractor shall submit for approval five (5) copies of all submittals to the Contractor's Designer of Record (CDOR). For all military projects an additional copy of all submittals (for information only) related to fire protection/detection systems shall be submitted to the Public Works Office for review by the Fire Chief. The mailing address for these submittals shall be obtained at the preconstruction conference. Items not to be submitted in quintuplicate, such as samples and test cylinders, shall be submitted accompanied by five (5) copies of ENG Form 4025.

#### 3.5.1.1 Government Conformance Review Submittals

After the Contractor's Designer of Record (CDOR) review of each submittal is complete, the CDOR shall forward three copies of each submittal, including all For Information Only (FIO) submittals, to the Government for the Government's conformance review. This submittal shall include the accompanying ENG Form 4025 and any CDOR review comments. This submittal must be provided to the Government prior to the installation of the materials listed in the submittal. One copy shall be sent to the Engineering and Construction Division (EC) addressed as follows:

US Army Engineering District, Kansas City  
 ATTN: CENWK-EC-D  
 Federal Building, 601 East 12th Street  
 Kansas City, Missouri 64106-2896

Two copy shall be sent to the Engineering and Construction Division (EC) addressed as follows:

Fort Riley Area Office  
 Box 2189  
 Fort Riley, KA 66442

### 3.5.2 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. As stated above, the Contractor's Designer of Record's approval is required for any proposed deviation. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

### 3.6 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved Submittal Register so the material needed date is not threatened.

### 3.7 GOVERNMENT CONFORMANCE REVIEW AND APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. Copies of the submittal will be retained by the COR and copies of the submittal will be returned to the Contractor. If the Government performs a conformance review of other Designer of Record

approved submittals, the submittals will be so identified and returned, as described above.

3.8 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the COR is not required on Information Only submittals. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the COR from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe. Provide distribution to the Government in accordance with Paragraph 3.5.1.1, prior to the installation of any materials in the submittal.

3.9 STAMPS

Stamps used by the Contractor's Designer of Record and the Contractor's designated Quality Control person on the submittal data to certify that the submittal meets contract requirements shall be similar to the following (use two stamps for submittals reviewed by both):

CONTRACTOR  
(Firm Name)

\_\_\_\_\_ Approved  
 \_\_\_\_\_ Approved with corrections as noted on submittal data  
 and/or attached sheet(s).

SIGNATURE: \_\_\_\_\_

TITLE: \_\_\_\_\_ Designer of Record \_\_\_\_\_

DATE: \_\_\_\_\_

CONTRACTOR  
(Firm Name)

\_\_\_\_\_ Approved  
 \_\_\_\_\_ Approved with corrections as noted on submittal data  
 and/or attached sheet(s).

SIGNATURE: \_\_\_\_\_

TITLE: \_\_\_\_\_ Designer of Record \_\_\_\_\_

DATE: \_\_\_\_\_

-- End of Section --

## SECTION 01420

SOURCES FOR REFERENCE PUBLICATIONS  
12/02

## 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.

ACI INTERNATIONAL (ACI)  
P.O. Box 9094  
Farmington Hills, MI 48333-9094  
Ph: 248-848-3700  
Fax: 248-848-3701  
Internet: <http://www.aci-int.org>

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)  
4301 North Fairfax Dr., Suite 425  
ATTN: Pubs Dept.  
Arlington, VA 22203  
Ph: 703-524-8800  
Fax: 703-528-3816  
E-mail: [ari@ari.org](mailto:ari@ari.org)  
Internet: <http://www.ari.org>

AIR CONDITIONING CONTRACTORS OF AMERICA (ACCA)  
2800 Shirlington Road, Suite 300  
Arlington, VA 22206  
Ph: 703-575-4477  
FAX: 703-575-4449  
Internet: <http://www.acca.org>

AIR DIFFUSION COUNCIL (ADC)  
1000 East Woodfield Road, Suite 102  
Shaumburg, IL 60173-5921  
Ph: 847-706-6750  
Fax: 847-706-6751  
Internet: <http://www.flexibleduct.org>

AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)  
30 W. University Dr.  
Arlington Heights, IL 60004-1893  
Ph: 847-394-0150  
Fax: 847-253-0088  
Internet: <http://www.amca.org>

ALUMINUM ASSOCIATION (AA)

900 19th Street N.W.  
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-- End of Section --

## SECTION 01451A

CONTRACTOR QUALITY CONTROL  
07/01

## 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 basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740	(2001) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(2000b) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

## 1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

## 3.1 GENERAL REQUIREMENTS

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. **The CQC System Manager will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the contract. The CQC System Manager shall report to the Project Manager or someone higher in the Contractor organization. Project Manager in this context shall mean the individual with responsibility for overall management of the project, including quality and production. The site project superintendent shall maintain a physical presence at the site at all times, except as otherwise acceptable to the Contracting Officer, and shall be responsible for all construction and construction related activities at the site.**

## 3.2 QUALITY CONTROL PLAN

The Contractor shall furnish for review by the Government, not later than 10 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The Government will consider an interim plan for the first 60 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

### 3.2.1 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

- a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.
- b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
- c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Government.
- d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01332 SUBMITTAL PROCEDURES.
- e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)
- f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.
- g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.

- h. Reporting procedures, including proposed reporting formats.
- i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

### 3.2.2 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

### 3.2.3 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

## 3.3 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

## 3.4 QUALITY CONTROL ORGANIZATION

### 3.4.1 Personnel Requirements

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure safety and contract compliance. The Safety and Health Manager shall receive direction and authority from the CQC System Manager and shall serve as a member of the CQC staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff shall maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff

shall be subject to acceptance by the Contracting Officer. The Contractor shall provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Complete records of all letters, material submittals, show drawing submittals, schedules and all other project documentation shall be promptly furnished to the CQC organization by the Contractor. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

3.4.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a construction person with a minimum of five (5) years in related work. This CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. The CQC System Manager shall be assigned no other duties. An alternate for the CQC System Manager shall be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager.

3.4.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization a person specialized to assist the CQC System Manager for the electrical and mechanical areas, and a submittals clerk. This individual shall be directly employed by the prime Contractor and may not be employed by a supplier or sub-contractor on this project; shall be responsible to the CQC System Manager; shall be physically present at the construction site during work on their areas of responsibility; and shall have the necessary experience. These individuals shall have no other duties other than quality control.

Experience Matrix

- a. Mechanical Graduate Mechanical Engineer with 2 yrs experience or person with 5 yrs related experience
- b. Electrical Graduate Electrical Engineer with 2 yrs related experience or person with 5 yrs related experience
- c. Submittals Submittal Clerk with 1 yr experience

3.4.4 Additional Requirement

In addition to the above experience and/or educational requirements, the CQC System Manager shall have completed the course entitled "Construction Quality Management for Contractors" within the past five years and shall be in possession of a valid certificate of instruction. If the individual designated as CQC System Manager does not currently meet this training

requirement, it is mandatory that the training be successfully completed within ninety calendar days of appointment to the position of CQC System Manager. The Contractor's CQC System Manager may be appointed and serve fully in that capacity pending certification, providing all other qualifications are met. If the CQC System Manager fails to successfully complete the training, the Contractor shall promptly appoint a new CQC System Manager who shall then attend the next available course if he/she does not have a current course certification. The certification is valid for five years at which time retraining is required. If the Contractor needs this training, it will be provided by Government personnel after award of the contract. The cost for the training course shall be borne by the Contractor and will not exceed one hundred dollars (\$100.00) per course, per person. Payment shall be by check in advance of the training. The Contractor shall contact the Contracting Officer upon award of the contract to arrange for course participation.

#### 3.4.5 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

#### 3.5 SUBMITTALS

Submittals, if needed, shall be made as specified in Section 01330 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements. When Section 15950A HEATING, VENTILATING AND AIR CONDITIONING (HVAC) CONTROL SYSTEMS; 15951A DIRECT DIGITAL CONTROL FOR HVAC; 15990A TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS; or 15995A COMMISSIONING OF HVAC SYSTEMS are included in the contract, the submittals required by those sections shall be coordinated with Section 01330 SUBMITTAL PROCEDURES to ensure adequate time is allowed for each type of submittal required.

#### 3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control shall be conducted by the CQC System Manager for each definable feature of work as follows:

##### 3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

- a. A review of each paragraph of applicable specifications, reference codes, and standards. A copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field shall be made available by the Contractor at the preparatory inspection. These copies shall be maintained in the field and available for use by Government personnel until final acceptance of the work.

- b. A review of the contract drawings.
- c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.
- d. Review of provisions that have been made to provide required control inspection and testing.
- e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
- f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
- g. A review of the appropriate activity hazard analysis to assure safety requirements are met.
- h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
- i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- j. Discussion of the initial control phase.
- k. The Government shall be notified at least 24 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

### 3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

- a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.
- c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- d. Resolve all differences.
- e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.

- f. The Government shall be notified at least 24 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
- g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

### 3.6.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon nor conceal non-conforming work.

### 3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

## 3.7 TESTS

### 3.7.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. The Contractor shall perform the following activities and record and provide the following data:

- a. Verify that testing procedures comply with contract requirements.
- b. Verify that facilities and testing equipment are available and comply with testing standards.
- c. Check test instrument calibration data against certified standards.
- d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
- e. Results of all tests taken, both passing and failing tests, shall be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the

sequential control number identifying the test shall be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility shall be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

### 3.7.2 Testing Laboratories

#### 3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

#### 3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge of \$3,500.00 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount due the Contractor.

### 3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

### 3.7.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials shall be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the Corps of Engineers Division Laboratory, f.o.b., at the following address:

For delivery by mail:  
 USACE Research and Development Center  
 ATTN: Joe Tom, CEERD-SC-E  
 3909 Halls Ferry Road  
 Vicksburg, MS 39180-6199  
 Commander, U.S. Army Engineer Research and Development Center  
 ATTN: Joe Tom, CEERD-SC-E  
 3909 Halls Ferry Road  
 Vicksburg, Mississippi 39180-6199

For other deliveries: Same as above.

Coordination for each specific test, exact delivery location, and dates will be made through the Area Office.

### 3.8 COMPLETION INSPECTION

### 3.8.1 Punch-Out Inspection

Near the end of the work, or any increment of the work established by a time stated in the Special Clause, "Commencement, Prosecution, and Completion of Work", or by the specifications, the CQC Manager shall conduct an inspection of the work. A punch list of items which do not conform to the approved drawings and specifications shall be prepared and included in the CQC documentation, as required by paragraph DOCUMENTATION. The list of deficiencies shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected.

Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

### 3.8.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Any items noted on the Pre-Final inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

### 3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice shall be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

## 3.9 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

- a. Contractor/subcontractor and their area of responsibility.
- b. Operating plant/equipment with hours worked, idle, or down for

repair.

- c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
- d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase shall be identified (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.
- e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- f. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.
- g. Offsite surveillance activities, including actions taken.
- h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
- i. Instructions given/received and conflicts in plans and/or specifications.
- j. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 12 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every 7 days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

### 3.10 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such 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 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 or for excess costs or damages by the Contractor.

-- End of Section --



## SECTION 01500A

TEMPORARY CONSTRUCTION FACILITIES  
02/97

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

## 1.1.1 Site Plan

The Contractor shall prepare a site plan indicating the proposed location and dimensions of any area to be fenced and used by the Contractor, the number of trailers to be used, avenues of ingress/egress to the fenced area and details of the fence installation. Any areas which may have to be graveled to prevent the tracking of mud shall also be identified. The Contractor shall also indicate if the use of a supplemental or other staging area is desired.

## 1.1.2 Identification of Employees

The Contractor shall be responsible for furnishing to each employee, and for requiring each employee engaged on the work to display, identification as approved and directed by the Contracting Officer. Prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of any employee. When required, the Contractor shall obtain and provide fingerprints of persons employed on the project. Contractor and subcontractor personnel shall wear identifying markings on hard hats clearly identifying the company for whom the employee works.

## 1.1.3 Employee Parking

Contractor employees shall 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 shall not interfere with existing and established parking requirements of the military installation.

## 1.2 AVAILABILITY AND USE OF UTILITY SERVICES

## 1.2.1 Payment for Utility Services

The Government will make all reasonably required utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

## 1.2.2 Meters and Temporary Connections

**The Contractor, at its expense and in a manner satisfactory to the Contracting Officer, shall provide and maintain necessary temporary**

connections, distribution lines, meters and meter bases required to measure the amount of each utility used for the purpose of determining charges. The Contractor shall notify the Contracting Officer, in writing, 5 working days before final electrical connection is desired so that a utilities contract can be established. The Contractor will provide a meter and make the final hot connection after inspection and approval of the Contractor's temporary wiring installation.

#### 1.2.3 Advance Deposit

An advance deposit for utilities consisting of an estimated month's usage or a minimum of \$50.00 will be required. The last monthly bills for the fiscal year will normally be offset by the deposit and adjustments will be billed or returned as appropriate. Services to be rendered for the next fiscal year, beginning 1 October, will require a new deposit. Notification of the due date for this deposit will be mailed to the Contractor prior to the end of the current fiscal year.

#### 1.2.4 Final Meter Reading

Before completion of the work and final acceptance of the work by the Government, the Contractor shall notify the Contracting Officer, in writing, 5 working days before termination is desired. The Government will take a final meter reading and disconnect service. The Contractor shall then remove all the temporary distribution lines, meters, meter bases, and associated paraphernalia. The Contractor shall pay all outstanding utility bills before final acceptance of the work by the Government.

#### 1.2.5 Sanitation

The Contractor shall provide and maintain within the construction area minimum field-type sanitary facilities approved by the Contracting Officer. Government toilet facilities will not be available to Contractor's personnel.

#### 1.2.6 Telephone

The Contractor shall make arrangements and pay all costs for telephone facilities desired.

### 1.3 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

#### 1.3.1 Bulletin Board

Immediately upon beginning of work, the Contractor shall provide a weatherproof glass-covered bulletin board not less than 915 by 1220 mm in size 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. The bulletin board shall be located at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Legible copies of the aforementioned data shall be displayed until work is completed. Upon completion of work the bulletin board shall be removed by and remain the property of the Contractor.

#### 1.3.2 Project and Safety Signs

The requirements for the signs, their content, and location shall be as shown on the examples provided at the end of this section. The signs shall

be erected within 15 days after receipt of the notice to proceed. The data required by the safety sign shall be corrected daily, with light colored metallic or non-metallic numerals. Upon completion of the project, the signs shall be removed from the site.

#### 1.4 PROTECTION AND MAINTENANCE OF TRAFFIC

During construction the Contractor shall provide access and temporary relocated roads as necessary to maintain traffic. The Contractor shall maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. 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 and the work, and the erection and maintenance of adequate warning, danger, and direction signs, shall be as required by the State and local authorities having jurisdiction. The traveling public shall be protected from damage to person and property. The Contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. The Contractor shall investigate the adequacy of existing roads and the allowable load limit on these roads. The Contractor shall be responsible for the repair of any damage to roads caused by construction operations.

##### 1.4.1 Haul Roads

The Contractor shall, at its own expense, construct access and haul roads necessary for proper prosecution of the work under this contract. Haul roads shall be constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided. The Contractor shall provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, shall be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads shall be subject to approval by the Contracting Officer. Lighting shall be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations. Upon completion of the work, haul roads designated by the Contracting Officer shall be removed.

##### 1.4.2 Barricades

The Contractor shall erect and maintain temporary barricades to limit public access to hazardous areas. Such barricades shall be required 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 shall be securely placed, clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

#### 1.5 CONTRACTOR'S TEMPORARY FACILITIES

##### 1.5.1 Administrative Field Offices

The Contractor shall 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.

##### 1.5.2 Storage Area

The Contractor shall construct a temporary 1.8 m high chain link fence around trailers and materials. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Trailers, materials, or equipment shall not be placed or stored 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 military boundaries. Trailers, equipment, or materials shall not be open to public view with the exception of those items which are in support of ongoing work on any given day. Materials shall not be stockpiled outside the fence in preparation for the next day's work. Mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment, shall be parked within the fenced area at the end of each work day.

#### 1.5.3 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but shall be within the military boundaries. Fencing of materials or equipment will not be required at this site; however, the Contractor shall be responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

#### 1.5.4 Appearance of Trailers

Trailers utilized by the Contractor for administrative or material storage purposes shall present a clean and neat exterior appearance and shall 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 the military property.

#### 1.5.5 Maintenance of Storage Area

Fencing shall be kept in a state of good repair and proper alignment. Should the Contractor elect to traverse, with construction equipment or other vehicles, grassed or unpaved areas which are not established roadways, such areas shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation shall be at the Contractor's discretion. Grass located within the boundaries of the construction site shall be mowed for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

#### 1.5.6 New Building

In the event a new building is constructed for the temporary project field office, it shall be a minimum 3.6 m in width, 5 m in length and have a minimum of 2.1 m headroom. It shall be equipped with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. It shall be provided with a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building shall be waterproof, shall be supplied with heater, shall have a minimum of two doors, electric lights, a telephone, a battery operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a

supply of approved drinking water. Approved sanitary facilities shall be furnished. The windows and doors shall be screened and the doors provided with dead bolt type locking devices or a padlock and heavy duty hasp bolted to the door. Door hinge pins shall be non-removable. The windows shall be arranged to open and to be securely fastened from the inside. Glass panels in windows shall be protected by bars or heavy mesh screens to prevent easy access to the building through these panels. In warm weather, air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 11 degrees C below the outside temperature when the outside temperature is 35 degrees C, shall be furnished. Any new building erected for a temporary field office shall be maintained by the Contractor during the life of the contract and upon completion and acceptance of the work shall become the property of the Contractor and shall be removed from the site. All charges for telephone service for the temporary field office shall be borne by the Contractor, including long distance charges up to a maximum of \$75.00 per month.

#### 1.5.7 Security Provisions

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

#### 1.6 GOVERNMENT FIELD OFFICE

##### 1.6.1 Resident Engineer's Office

The Contractor shall provide the Government Resident Engineer with an office, approximately 19 square meters in floor area, located where directed and providing space heat, electric light and power, and toilet facilities consisting of one lavatory and one water closet complete with connections to water and sewer mains. A mail slot in the door or a lockable mail box mounted on the surface of the door shall be provided. At completion of the project, the office shall remain the property of the Contractor and shall be removed from the site. Utilities shall be connected and disconnected in accordance with local codes and to the satisfaction of the Contracting Officer.

##### 1.6.2 Trailer-Type Mobile Office

The Contractor may, at its option, furnish and maintain a trailer-type mobile office acceptable to the Contracting Officer and providing as a minimum the facilities specified above. The trailer shall be securely anchored to the ground at all four corners to guard against movement during high winds.

#### 1.7 PLANT COMMUNICATION

Whenever the Contractor has the individual elements of its plant so located that operation by normal voice between these elements is not satisfactory, the Contractor shall install a satisfactory means of communication, such as telephone or other suitable devices. The devices shall be made available for use by Government personnel.

#### 1.8 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date

established for commencement of work, the Contractor shall furnish and erect temporary project safety fencing at the work site. The safety fencing shall be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 1.1 m high, supported and tightly secured to steel posts located on maximum 3 m centers, constructed at the approved location. The safety fencing shall be maintained by the Contractor during the life of the contract and, upon completion and acceptance of the work, shall become the property of the Contractor and shall be removed from the work site.

#### 1.9 CLEANUP

Construction debris, waste materials, packaging material and the like shall be removed from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways shall be cleaned away. Materials resulting from demolition activities which are salvageable shall be stored within the fenced area described above or at the supplemental storage area. Stored material not in trailers, whether new or salvaged, shall be neatly stacked when stored.

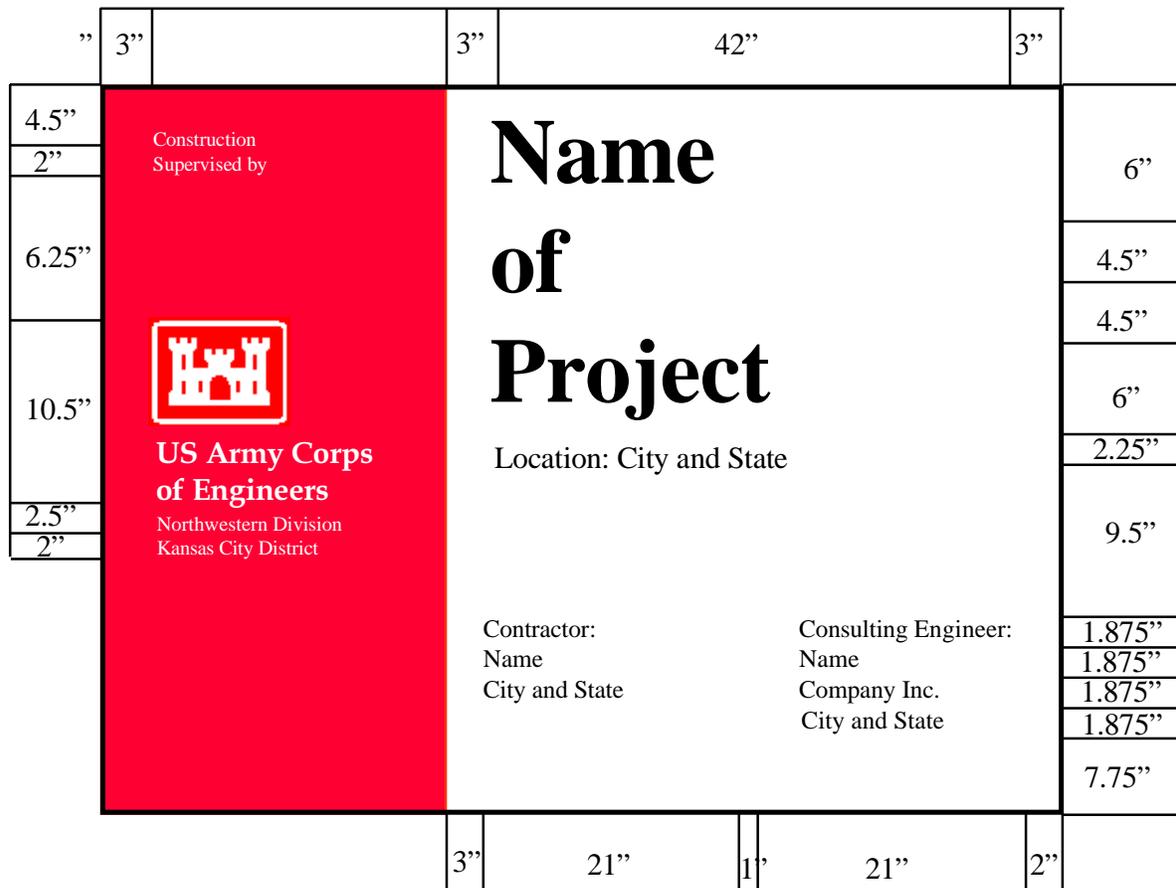
#### 1.10 RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used by the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary.

-- End of Section --

The graphic format for this 4'x 6' sign panel follows the legend guidelines and layout as specified below. The large 4'x 4' section of panel on the right is to be white with black legend. The 2'x 4' section of the sign on the left with the full Corps signature (reverse version) is to be screen printed Communications Red on the White background.

This sign is to be placed with the Safety Performance Sign (See Fig. 2).



Legend Group 1: One to two-line description of Corps relationship to project  
Color: White  
Typeface: 1.25" Helvetica Regular  
Maximum line length: 19"

Legend Group 2: Division\ District Name Placed below 10.5" Reverse Signature (6" Castle).  
Color: White  
Typeface: 1.25" Helvetica Regular

Legend Group 3: One- to three-line project title legend describes the work being done under this contract.  
Color: Black  
Typeface: 3" Helvetica Bold  
Maximum line length: 42"

Legend Group 4: One- to two-line identification of project or facility (civil works) or name of sponsoring department (military).  
Color: Black  
Typeface: 1.5" Helvetica Regular  
Maximum line length: 42"

Cross-align the first line of Legend Group 4 with the first line of the Corps Signature (US Army Corps) as shown.

Legend Groups 5a-b: One- to five-line identification of prime contractors including: type (architect, general contractor, etc.), corporate or firm name, city, state. Use of Legend Group 5 is optional.  
Color: Black  
Typeface: 1.25" Helvetica Regular  
Maximum line length: 21"

All typography is flush left and rag right, upper and lower case with initial capitals only as shown. Letter- and word-spacing to follow Corps standards

Sign Type	Legend Size	Panel Size	Post Size	Specification Code	Mounting Height	Color Bkg/Lgd
CID-01	Various	4' x 6'	4' x 4'	HDO-3	48"	WH-RD/BK

**CONSTRUCTION SIGN (CORPS OF ENGINEERS DESIGN)**  
(Use with Fig 2)

Fig. 1

# SAFETY PERFORMANCE SIGN

Each contractor's safety record is to be posted on Corps managed or supervised construction projects and mounted with the construction project identification sign.

The graphic format, color, size and typefaces used on the sign are to be reproduced exactly as specified below. The title with First Aid logo in the top section of the sign and the performance record captions are standard for all signs of the type. Legend Groups 2 and 3 below identify the project and the contractor and are to be placed on the sign as shown.

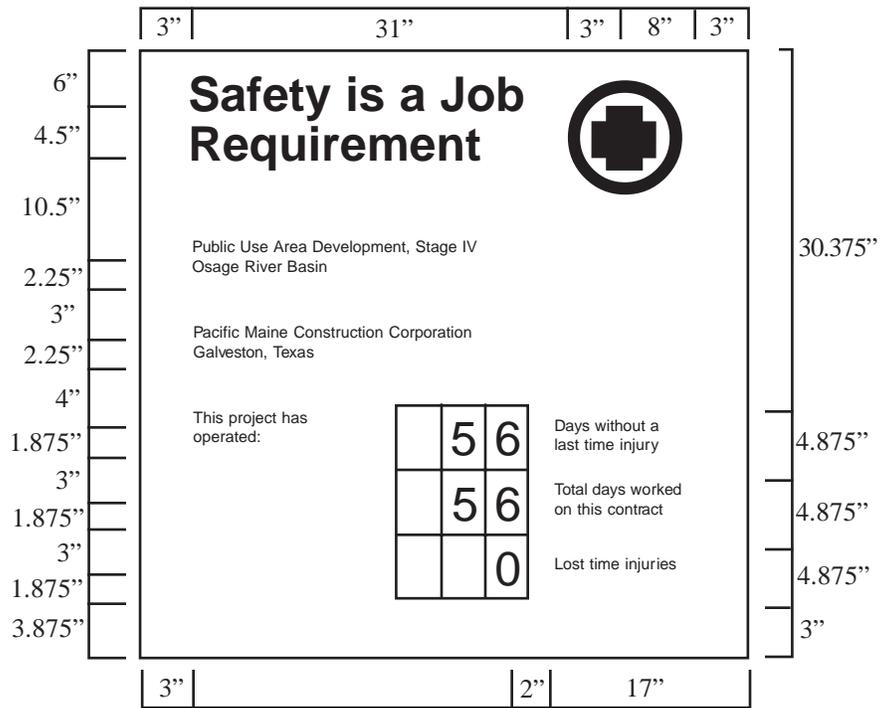
Safety record numbers are mounted on individual metal plates and are screw mounted to the background to allow for daily revisions to posted safety performance record.

**Legend Group 1:** Standard two-line title "Safety is a Job requirement" with (8 od.) Safety Green First Aid logo.  
Color: to match PMS 347  
Typeface: 3" Helvetica Bold  
Color: Black

**Legend Group 2:** One to two-line project title legend describes the work being done under this contract and name of host project.  
Color: Black  
Typeface: 1.5" Helvetica Regular  
Maximum line length: 42"

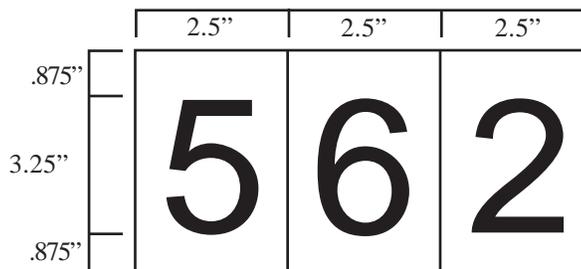
**Legend Group 3:** One to two-line identification; name of prime contractor and city, state address.  
Color: Black  
Typeface: 1.5" Helvetica Regular  
Maximum line length: 42"

**Legend Group 4:** Standard safety record captions as shown.  
Color: Black  
Typeface: 12.5" Helvetica Regular



Sign Type	Legend Size	Panel Size	Post Size	Specification Code	Mounting Height	Color Bkg/Lgd
CID-02	Various	4' X 4'	4" X 4"	HDO-3	48"	WH/BK - GR

Replaceable numbers are to be mounted on white .060 aluminum plates and screw-mounted to background.  
Color: Black  
Typeface: 3" Helvetica Regular  
Plate size: 2.5" X 5"



All typography is flush left and rag right. Upper and lower case with initial capitals only as shown. Letter - and word - spacing to follow Corps standards.

Fig. 2

## SECTION 01780A

## CLOSEOUT SUBMITTALS

11/99

## PART 1 GENERAL

## 1.1 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01332 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

As-Built Drawings; G-RE.

Drawings showing final as-built conditions of the project. The final CADD as-built drawings shall consist of one set of electronic CADD drawing files in the specified format, one set of mylar drawings, 2 sets of blue-line prints of the mylars, and one set of the approved working as-built drawings.

## SD-03 Product Data

As-Built Record of Equipment and Materials; G-RE.

Two copies of the record listing the as-built materials and equipment incorporated into the construction of the project.

Warranty Management Plan; G-RE.

One set of the warranty management plan containing information relevant to the warranty of materials and equipment incorporated into the construction project, including the starting date of warranty of construction. The Contractor shall furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.

Warranty Tags; G-RE

Two record copies of the warranty tags showing the layout and design.

Final Cleaning; G-RE.

Two copies of the listing of completed final clean-up items.

## 1.2 PROJECT RECORD DOCUMENTS

## 1.2.1 As-Built Drawings

This paragraph covers as-built drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files,"

"working as-built drawings" and "final as-built drawings" refer to contract drawings which are revised to be used for final as-built drawings.

#### 1.2.1.1 Government Furnished Materials

One set of CADD files in the specified software and format revised to reflect all bid amendments will be provided by the Government at the preconstruction conference. These files are for no other purpose than the formulation of the as-built and record drawings. The as-bid documents will govern in all instances of difference between the CADD files furnished and the as-bid documents.

#### 1.2.1.2 Working As-Built and Final As-Built Drawings

The Contractor shall revise 2 sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. These working as-built marked drawings shall be kept current on a weekly basis and at least one set shall be 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 shall be accurately and neatly recorded as they occur by means of details and notes.

Final as-built drawings shall be prepared 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 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. If the Contractor fails to maintain the working and final as-built drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the as-built drawings. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of updated drawings. The working and final as-built drawings shall show, but shall not be 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, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Valves, splice boxes and similar appurtenances shall be located by dimensioning along the utility run from a reference point. The average depth below the surface of each run shall also be recorded.

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, only the option selected for construction shall be shown 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, the Contractor shall 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 (change order price shall include the Contractor's cost to change working and final as-built drawings to reflect modifications) and compliance with the following procedures.

- (1) Directions in the modification for posting descriptive changes shall be followed.
- (2) A Modification Circle shall be placed at the location of each deletion.
- (3) For new details or sections which are added to a drawing, a Modification Circle shall be placed by the detail or section title.
- (4) For minor changes, a Modification Circle shall be placed by the area changed on the drawing (each location).
- (5) For major changes to a drawing, a Modification Circle shall be placed by the title of the affected plan, section, or detail at each location.
- (6) For changes to schedules or drawings, a Modification Circle shall be placed either by the schedule heading or by the change in the schedule.
- (7) The Modification Circle size shall be 12.7 mm diameter unless the area where the circle is to be placed is crowded. Smaller size circle shall be used for crowded areas.

#### 1.2.1.3 Drawing Preparation

The as-built drawings shall be modified as may be necessary to correctly show the features of the project as it has been 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 shall be neat, legible and accurate. These drawings are part of the permanent records of this project and shall be returned to the Contracting Officer after approval by the Government. Any drawings damaged or lost by the Contractor shall be satisfactorily replaced by the Contractor at no expense to the Government.

#### 1.2.1.4 Computer Aided Design and Drafting (CADD) Drawings

Only personnel proficient in the preparation of CADD drawings shall be employed to modify the contract drawings or prepare additional new

drawings. Additions and corrections to the contract drawings shall be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols shall be the same as the original line colors, line weights, lettering, layering conventions, and symbols. If additional drawings are required, they shall be prepared using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final as-built drawings shall be identical to that used on the contract drawings. Additions and corrections to the contract drawings shall be accomplished using CADD files. The electronic files will be supplied on compact disc, read-only memory (CD-ROM). The Contractor shall be responsible for providing all program files and hardware necessary to prepare final as-built drawings. The Contracting Officer will review final as-built drawings for accuracy and the Contractor shall make required corrections, changes, additions, and deletions.

a. CADD colors shall be the "base" colors of red, green, and blue. Color code for changes shall be as follows:

(1) Deletions (red) - Deleted graphic items (lines) shall be colored red with red lettering in notes and leaders.

(2) Additions (Green) - Added items shall be drawn in green with green lettering in notes and leaders.

(3) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes shall be in blue.

b. The Contract Drawing files shall be renamed in a manner related to the contract number (i.e., 98-C-10.DGN) as instructed in the Pre-Construction conference. Marked-up changes shall be made only to those renamed files. All changes shall be made on the layer/level as the original item. There shall be no deletions of existing lines; existing lines shall be over struck in red. Additions shall be in green with line weights the same as the drawing. Special notes shall be in blue on layer #63.

c. When final revisions have been completed, the cover sheet drawing shall show the wording "RECORD DRAWING AS-BUILT" followed by the name of the Contractor in letters at least 5 mm high. All other contract drawings shall be marked either "AS-Built" drawing denoting no revisions on the sheet or "Revised As-Built" denoting one or more revisions. Original contract drawings shall be dated in the revision block.

d. Within 20 days after Government approval of all of the working as-built drawings for a phase of work, the Contractor shall prepare the final CADD as-built drawings for that phase of work and submit two sets of blue-lined prints of these drawings for Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days the Contractor shall revise the CADD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 20 days of substantial completion of all phases of work, the Contractor shall submit the final as-built drawing package for the entire project. The submittal shall consist of one set of electronic files on compact disc, read-only memory (CD-ROM), one set of mylars, two sets of blue-line prints and one set of the approved working as-built drawings. They shall be complete in all details and identical in form and function to the contract drawing

files supplied by the Government. Any transactions or adjustments necessary to accomplish this is the responsibility of the Contractor. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CADD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final as-built drawing files and marked prints as specified shall be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final as-built drawings shall be accomplished before final payment is made to the Contractor.

#### 1.2.1.5 Manually Prepared Drawings

Only personnel proficient in the preparation of manually prepared drawings shall be employed to modify the original contract drawing or prepare additional new drawings. Additions and corrections to the contract drawings shall be neat, clean and legible, shall be done to the same level of detail, and shall match the adjacent existing line work, and lettering being annotated in type, density, size and style. Drafting work shall be done using the same medium (pencil, plastic lead or ink) that was employed on the original contract drawings and with graphite lead on paper base material. The Contracting Officer will review as-built drawings for accuracy and conformance to the above specified drafting standards. Corrections, changes, additions, and deletions required shall meet these standards. The title block to be used for any new as-built drawings shall be similar to that used on the original drawings.

a. When final revisions have been completed, each drawing shall be lettered or stamped with the words "RECORD DRAWING AS-BUILT" followed by the name of the Contractor in letters at least 5 mm high. Original contract drawings shall be marked either "As-Built" drawings denoting no revisions on the sheet or "Revised As-Built" denoting one or more revisions. All original contract drawings shall be dated in the revision block.

b. Within 20 days after Government approval of all of the working as-built drawings for a phase of work, the Contractor shall prepare the final as-built drawings for that phase of work and submit two sets of blue-line prints of these drawings for Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days the Contractor shall revise the drawings accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 20 days of substantial completion of all phases of work, the Contractor shall submit the final as-built drawing package for the entire project. The submittal shall consist of the completed final as-built drawings, two blue-line prints of these drawings and the return of the approved marked as-built prints. The drawings shall be complete in all details. Paper prints and reproducible drawings will become the property of the Government upon final approval. Failure to submit final as-built drawings and marked prints, as required herein, will be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final as-built drawings shall be accomplished before final payment is made to the Contractor.

#### 1.2.1.6 Payment

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

1.2.2 As-Built Record of Equipment and Materials

The Contractor shall furnish one copy 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. Two sets of final record of equipment and materials shall be submitted 10 days after final inspection. The designations shall be keyed to the related area depicted on the contract drawings. The record shall 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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1.2.3 Final Approved Shop Drawings

The Contractor shall furnish final approved project shop drawings 30 days after transfer of the completed facility.

1.2.4 Construction Contract Specifications

The Contractor shall furnish final as-built construction contract specifications, including modifications thereto, 30 days after transfer of the completed facility.

1.2.5 Real Property Equipment

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

1.3 WARRANTY MANAGEMENT

1.3.1 Warranty Management Plan

The Contractor shall develop a warranty management plan which shall contain information relevant to the clause "Warranty of Construction". At least 30 days before the planned pre-warranty conference, the Contractor shall submit the warranty management plan for Government approval. The warranty management plan shall include all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan shall 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 shall include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase shall be submitted to the Contracting Officer for approval prior to each monthly pay estimate.

Approved information shall be assembled in a binder and shall be turned over to the Government upon acceptance of the work. The construction warranty period shall begin on the date of project acceptance and shall continue for the full product warranty period. A joint 4 month and 9 month warranty inspection shall be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Information contained in the warranty management plan shall include, but shall not be 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. 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.

c. 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. This shall include one-year overall warranty of construction. Items which have extended warranties shall 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.

d. The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.

e. Procedure and status of tagging of all equipment covered by extended warranties.

f. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

#### 1.3.2 Performance Bond

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

a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer

will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, the Contractor shall respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor.

### 1.3.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, the Contractor shall 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 shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor shall 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, shall be continuously available, and shall 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.

### 1.3.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, the Contractor shall respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. The Contractor shall submit a report on any warranty item that has been repaired during the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframes specified, the Government will perform the work and backcharge the construction warranty payment item established.

a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.

d. The "Construction Warranty Service Priority List" is as follows:

Code 1-Air Conditioning Systems

- (1) Recreational support.
- (2) Air conditioning leak in part of building, if causing damage.
- (3) Air conditioning system not cooling properly.

Code 1-Doors

- (1) Overhead doors not operational, causing a security, fire, or safety problem.
- (2) Interior, exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

Code 3-Doors

- (1) Overhead doors not operational.
- (2) Interior/exterior personnel doors or hardware not functioning properly.

Code 1-Electrical

- (1) Power failure (entire area or any building operational after 1600 hours).
- (2) Security lights
- (3) Smoke detectors

Code 2-Electrical

- (1) Power failure (no power to a room or part of building).
- (2) Receptacle and lights (in a room or part of building).

Code 3-Electrical

Street lights.

Code 1-Gas

- (1) Leaks and breaks.
- (2) No gas to family housing unit or cantonment area.

Code 1-Heat

- (1). Area power failure affecting heat.
- (2). Heater in unit not working.

Code 2-Kitchen Equipment

- (1) Dishwasher not operating properly.
- (2) All other equipment hampering preparation of a meal.

Code 1-Plumbing

- (1) Hot water heater failure.
- (2) Leaking water supply pipes.

Code 2-Plumbing

- (1) Flush valves not operating properly.
- (2) Fixture drain, supply line to commode, or any water pipe leaking.
- (3) Commode leaking at base.

Code 3 -Plumbing

Leaky faucets.

Code 3-Interior

- (1) Floors damaged.

- (2) Paint chipping or peeling.
- (3) Casework.

Code 1-Roof Leaks

Temporary repairs will be made where major damage to property is occurring.

Code 2-Roof Leaks

Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 2-Water (Exterior)

No water to facility.

Code 2-Water (Hot)

No hot water in portion of building listed.

Code 3-All other work not listed above.

1.3.5 Warranty Tags

At the time of installation, each warranted item shall be tagged with a durable, oil and water resistant tag approved by the Contracting Officer. Each tag shall be attached with a copper wire and shall be sprayed with a silicone waterproof coating. The date of acceptance and the QC signature shall remain blank until project is accepted for beneficial occupancy. The tag shall show the following information.

- 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\_\_\_\_\_.
- i. Warranty response time priority code\_\_\_\_\_.

j. WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.

1.4 MECHANICAL TESTING, ADJUSTING, BALANCING, AND COMMISSIONING

Prior to final inspection and transfer of the completed facility; all reports, statements, certificates, and completed checklists for testing, adjusting, balancing, and commissioning of mechanical systems shall be submitted to and approved by the Contracting Officer as specified in applicable technical specification sections.

#### 1.5 OPERATION AND MAINTENANCE MANUALS

Operation manuals and maintenance manuals shall be submitted as specified. Operation manuals and maintenance manuals provided in a common volume shall be clearly differentiated and shall be separately indexed.

#### 1.6 FINAL CLEANING

The premises shall be left broom clean. Stains, foreign substances, and temporary labels shall be removed from surfaces. Carpet and soft surfaces shall be vacuumed. Equipment and fixtures shall be cleaned to a sanitary condition. Filters of operating equipment shall be replaced. Debris shall be removed from roofs, drainage systems, gutters, and downspouts. Paved areas shall be swept and landscaped areas shall be raked clean. The site shall have waste, surplus materials, and rubbish removed. The project area shall have temporary structures, barricades, project signs, and construction facilities removed. A list of completed clean-up items shall be submitted on the day of final inspection.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

DIVISION 2 – SITE WORK

02000	Division 02: Site Work - Outline Specifications
02620	Subdrainage System
02700	Asphaltic Concrete Intermediate Leveling And Surface Courses (Central Plant Hot Mix)
02714	Rapid Drainage Layer
02721	Subbase Courses
02721A	Subbase Courses
02722	Graded, Crushed Aggregate Base Course And Rigid Base Course
02722A	Aggregate And/Or Graded-Crushed Aggregate Base Course
02748	Bituminous Tack And Prime Coats
02748A	Bituminous Tack And Prime Coats
02753	Concrete Pavement For Airfields And Other Heavy-Duty Pavements
02760	Field Molded Sealants For Sealing Joints In Rigid Pavements
02763	Pavement Markings

## SECTION 02000

DIVISION 02: SITE WORK - OUTLINE SPECIFICATIONS  
02/02

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENT

## Contractor Edited Guide Specifications

The contractor shall edit and provide the following UFGS guide specifications for Division 02: SITE WORK. Refer to the BASE STANDARDS 01140 and 01012 for contractual guidance to be included in the edited specifications.

## Section 02220, DEMOLITION

## 1. Oil/Water Separator (OWS) Removal and Disposal

As part of demolition of building 980, the Contractor shall remove and dispose of the underground OWS located on the west side of the building. Removal and disposal of the OWS shall be performed in accordance with the procedures of the American Petroleum Institute (API) Recommend Practice 1604, Removal and Disposal of Used Underground Petroleum Storage Tanks.

## 1.1 OWS Contents:

As part of the OWS removal and disposal, the Contractor shall be required to remove, collect, and dispose of the contents at an approved off-site disposal facility. Prior to removal of the contents, the Contractor shall collect a sample of the contents and analyze it for the parameters required by the off-site disposal facility. The contents of the OWS are anticipated to be a mixture of water and petroleum products. Potential petroleum products that may be contained in OWS are motor oil, jet fuel, mo gas, and diesel fuel. The Contractor shall not remove the content of the OWS or ancillary piping and equipment until a facility has been identified that is permitted and has agreed to accept the contents for disposal. The contractor shall assume that OWS contains 1,000 gallons of petroleum contaminated liquid requiring off-site disposal.

## 1.2 OWS and Ancillary Piping Removal:

The Contractor shall remove the OWS and all associated piping. This includes piping which extends from the building to the OWS and the sanitary sewer lateral extending from the OWS to the sanitary sewer main. The sanitary sewer lateral shall be cut off and capped within two feet from the main using an approved pipe cap.

## 1.3 Contaminated Soil Excavation:

The Contractor shall excavate only the amount of soil necessary to remove the OWS and associated piping or as directed by the Contracting Officer. During excavation, soil that is visually contaminated shall be segregated from soils that are not visually contaminated. Visually contaminated soil shall be stockpiled as described in paragraph: Stockpiling Contaminated Soil. After the OWS and piping have been removed, the Contractor shall remove visually

contaminated soil from below the OWS and piping at as directed by the Contracting Officer. The Contractor shall assume that there will be 100 cubic yards of petroleum contaminated soil requiring disposal at a permitted off-site disposal facility.

#### 1.4 Stockpiling Contaminated Soil:

Excavated soil that shows signs of contamination shall be stockpiled separately from non-contaminated soils. The segregation of contaminated and non-contaminated shall be determined by visual inspection and the use of a photoionization detector (PID). Stockpiles shall be placed a safe distance away from the excavation. Both contaminated and non-uncontaminated stockpiles shall be placed on an impermeable geomembrane a minimum of 10 mils thick, and covered with a geomembrane a minimum of 6 mils thick. The geomembrane shall be placed to prevent the stockpiled soil from coming into contact with surface water run-off. The cover shall prevent rain or surface water from coming into contact with the contaminated soil, as well as limit the escape of the volatile constituents in the stockpile. Stockpiles shall be sampled in accordance with paragraph: Chemical Testing Requirements. Soil that is below the Kansas Petroleum Site Remediation Levels (TPH < 100 mg/kg, Benzene < 1.4 mg/kg, and 1,2-Dichloroethane < 8 mg/kg) shall used for backfill in the tank excavation prior to using borrow material. Soil that exceeds these limits shall be disposed of at a permitted off-site facility.

#### 1.5 Soil Sampling in OWS and Piping Excavations

The provide documentation of any contamination that will remain in the ground after backfill of the excavations to remove the OWS and associated piping, the Contractor shall collect a 1 soil sample from below the OWS, 1 soil sample from the downgradient sidewall from the OWS excavation, and 1 soil sample for every 100 linear feet of excavation to remove the sanitary sewer piping. Samplings will be analyzed for the parameters and by the methods identified in Tables 1 and 2 respectively.

#### 1.6 Health and Safety Requirements:

Demolition activities related to the OWS may present unique hazards to workers including chemical, fire, confined space, buried utilities, and excavation hazards. The Contractor's Accident Prevention Plan shall detail preventive measures and contain completed activity hazard analyses, as per EM 385-1-1, 01.A.09, that clearly delineate the methods and work practices that will minimize chemical and physical hazards related to removing combustible materials, cleaning, excavation, and demolition of the OWS and associated piping.

#### 1.7 Chemical Testing Requirements:

##### 1.7.1 Sampling and Analysis Plan (SAP)

The SAP shall be prepared in accordance with EM 200-1-3. The SAP shall be a two-part document that contains two distinct elements: Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP). Sections of the FSP and QAPP shall be cross-referenced. The SAP shall confirm the Contractor's understanding of the contract requirements for chemical data quality control, and shall describe procedures for field sampling and sample submittal for analysis, field chemical parameter measurement, data documentation, data assessment and data reporting requirements. The SAP shall delineate the methods the Contractor intends to use to accomplish the chemical quality control items to assure accurate, precise, representative, complete, legally

defensible and comparable data. The SAP shall describe all chemical parameter measurements for all matrices for all phases of the remediation contract. As a single interrelated document, the SAP shall be provided to field and laboratory personnel. The Contractor may propose original/innovative approaches to chemical parameter measurements for cost reduction and remediation efficiency by abbreviated sampling, contingency sampling and/or contingency analysis, indicator or tracer analysis, onsite analytical services, equivalency or screening methods. The SAP shall clearly identify the Contractor obtained laboratories. The Contractor shall furnish copies of the Government approved SAP to all laboratories and the Contractor's field sampling crew. The SAP shall address all levels of the investigation with enough detail to become a document which may be used as an audit guide for field and laboratory work.

#### 1.7.1.1 Field Sampling Plan (FSP)

The FSP shall contain necessary technical detail and direction for the field personnel to understand sampling and field measurement requirements. The FSP shall provide a comprehensive description and full detail for personnel to perform all onsite activities required to attain project DQO, including: locations of samples, sampling procedures for onsite and offsite chemical analysis, summaries of analyses to be performed on samples, shipment of samples for offsite analyses, performance of onsite and offsite instrumental parameter measurements, data documentation and reporting requirements.

#### 1.7.1.2 Quality Assurance Project Plan (QAPP)

The QAPP shall contain necessary technical detail and direction for field and laboratory personnel to understand project sample analysis, quality control and data reporting requirements, analytical methods, required detection limits, QC requirements, and data validation and reporting requirements.

#### 1.7.2 Chemistry Data Package

The chemistry data package shall be produced and submitted to the Contracting Officer. The chemistry data package shall contain information to demonstrate that the project's Data Quality Objectives have been fulfilled. All the analytical results shall be a part of the chemistry data package.

**Table 1. Sample Locations/Matrix**

Location (#Samples)	Analyses <sup>1</sup>	Matrix
Excavation groundwater (Final as required by KDHE)	Benzen <sup>1</sup> ,2-DCA <sup>2</sup> Naphthalene	Water
Soil Samples for Excavation Contamination Documentation (2 for OWS, 1/100 feet of piping trench)	TPH VOCs TAL metals	Soil
Stockpiled Soil (1/100 cubic yards)	TPH VOCs TAL metals and any additional analyses required by the disposal facility	Soil
Tank Contents	As required by disposal facility	Liquid/Solid
Rinsate of sampling equipment,OWS, and piping	As required by disposal facility	Liquid
Imported Backfill - one composite sample per 500 cubic yards	TCL SVOC TCL VOC TCL PCB/Pest TAL Metals	Soil

1 - Analytical Methods specified in Table 2.

2 - 1,2 - dichloroethane.

TPH - Total Petroleum Hydrocarbons.

**Table 2. Analytical Methods/Quantitation Limits**

Analyte	Method		Reporting	Limits
	Solid/Soil	Liquid/Water	Solid/Soil	Liquid/Water (ug/L)
TPH (gasoline range)	Iowa Method OA-1 (gasoline range)	NA	As required by KDHE	NA
TPH (diesel range)	Iowa Method OA-2 (diesel range)	NA	As required by KDHE	NA
SVOC TCL	EPA Method 8270C	NA	MDL	NA
TCL PCB/ Pesticides	EPA Method 8081	NA	35 ug/kg <sup>2</sup>	NA
TCL VOC	EPA Method 8260B	EPA Method 8260B (If groundwater encountered)	Detection limit specified by method	Detection limit specified by method
Metals	EPA Methods 6010A and 7000 series	NA	Detection limit specified by method	N/A

mg/kg - milligrams/kilograms.

ug/kg - micrograms/kilogram

ug/L - micrograms/liter

N/A - Not Applicable

TPH - total petroleum hydrocarbons.

1 - Estimated quantitation limits are on a wet weight basis. Actual sample data should be reported on a dry weight basis; the actual quantitation limits will therefore vary according to the % moisture of each sample.

2 - Detection limits for non-aqueous samples are highly matrix dependent.

Estimates of soil detection limits are provided for reference only, and will not necessarily apply to the project-specific matrices

Section 02230, CLEARING AND GRUBBING

Section 02300, EARTHWORK

Section 02315, EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS

Section 02316, EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES

Section 02510, WATER DISTRIBUTION SYSTEM

Section 02555A, PREFABRICATED UNDERGROUND HEATING/COOLING DISTRIBUTION

SYSTEM

Section 02556A, GAS DISTRIBUTION SYSTEM

Section 02620A, SUBDRAINAGE SYSTEM

Section 02630, STORM DRAINAGE SYSTEM

Section 02663, PAVEMENT MARKINGS

Section 02821, FENCING

Section 02921A, SEEDING

Section 02922A, SODDING

Section 02930, EXTERIOR PLANTING

Section 02935, EXTERIOR PLANT MAINTENANCE

1.1.1 Kansas Department of Transportation Specifications

The Contractor shall use The Kansas Department of Transportation, "STANDARD SPECIFICATIONS FOR STATE ROAD AND BRIDGE CONSTRUCTION" for the specification items listed in paragraph 1.3 below.

1.1.2 Government Edited Specifications

The contractor shall incorporate the following government-supplied, fully edited specification sections as part of the project design:

1.2 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 977	(1991) Emulsified Asphalt
ASTM D 2027	(1976; R 1992) Cutback Asphalt (Medium-Curing Type)
ASTM D 2028	(1976; R 1992) Cutback Asphalt (Rapid-Curing Type)
ASTM D 2397	(1994) Cationic Emulsified Asphalt

CODE OF FEDERAL REGULATIONS (CFR)

28 CFR Part 36; Appendix A	(1994) Americans with Disabilities Act (ADA) Standards for Accessible Design
36 CFR 1191 RIN 3014 AA17	(1998) Americans with Disabilities Act

Accessibility Guidelines (ADAAG) for  
Buildings and Facilities; Building  
Elements Designed for Children's Use

1.3 Kansas Department of Transportation, "STANDARD SPECIFICATIONS FOR STATE ROAD AND BRIDGE CONSTRUCTION".

Measurement and Payment paragraphs in KDOT specifications shall not apply.

1.3.1 Material and Performance Criteria

A. Excavation for roads, parking lots, and other surfaced areas shall conform to state specification section 204.

Testing:

In-place field density testing and frequency of testing shall conform to state specifications. Field density tests are to be taken at a frequency not less than one test every 1,000 square meters per lift of embankment or subgrade. Laboratory density and moisture testing will be performed at a rate of one test per 500 cubic meters of material placed or when there is a change of material. During construction of embankments or fills, the working surface will be sloped to prevent the ponding of water. After completion, newly graded areas will be protected from traffic and erosion.

B. Embankments and fills: Embankments and fills shall be constructed and tested in accordance with the Kansas State Department of Transportation "STANDARD SPECIFICATIONS FOR STATE ROAD AND BRIDGE CONSTRUCTION", referred to herein as state specification. The latest edition and revisions of the state specification shall be used for all work.

C. Pre-construction testing requirements: All mix designs, and materials proposed for use in the work shall be tested initially for conformance to state specification requirements prior to delivering the materials to the project site. Certified copies of laboratory test reports shall verify that mix designs conform to state specification and the requirements specified herein. Certified copies of laboratory test reports shall verify that aggregate gradations, composition, and quality requirements, and other materials proposed for use in the work conform to state specification. A certified copy of each mix design and materials test reports, shall be submitted to: U.S. Army Corps of Engineers, CENWK-EC-GL for review. The above mix design and materials test report submittals shall be submitted during the project design. The mix design, and materials test report submittals, shall include names of companies and contractor's performing the mix design and testing, with a listing of all sources of materials and aggregates proposed for use in the work. The listing shall include a point of contact and telephone number for each material type and source.

D. Construction testing: Portland cement concrete, asphalt concrete mixtures shall be tested during construction in accordance with state specification, and certified laboratory reports shall be submitted to the Contracting Officer within 24 hours following completion of the test. In place density, compacted thickness, and gradation testing for each course shall be accomplished in accordance with the requirements and testing frequency specified in the state specification. Where the state specification testing frequency for subgrade, aggregate courses, and surface courses is not defined or is greater than 1,000 square

meters, a minimum testing requirement of 1,000 square meters for each course or lift shall be used. All testing required on each course or lift shall be accomplished prior to commencing construction of the next course or lift. A certified copy of each test report for all testing, shall be submitted to the contracting officer within 24 hours following completion of the test. The materials testing laboratory shall conform to the state requirements for testing laboratories.

E. Asphalt concrete shall conform to state specification section 605, PLANT MIX BITUMINOUS MIXTURE - COMMERCIAL GRADE. The grade of asphalt cement shall not be changed without an approved laboratory mix design. It shall also comply with KDOT Special Provisions 90M-197 Latest Revision and 90M-0196 Latest Revision. A certified refinery analysis from the proposed source shall be submitted with the mix design. Aggregates for asphalt concrete (bituminous mixtures) shall conform to state specification section 1103.

In addition the following requirements pertain:

The Total aggregate (coarse aggregate, fine aggregate, and mineral filler passing the 75 um (No. 22 sieve) shall contain not less than 85 percent crushed material. All bituminous mixtures shall contain an anti-stripping agent. AD-here LOF 65-00 LS as manufactured by ARR-MAZ Products, L.P. shall be added to the asphalt cement at the rate of 0,75% by weight of the asphalt cement. Other asphalt anti-stripping additives and their application rate may be used when proven equal after testing in accordance with ASSHTO T 283-89. Asphalt concrete mixtures shall be tested in accordance with ASSHTO T 283, and shall have a retained strength of at least 80 percent. Asphalt cement shall conform to ASSHTO-MPI Performance Graded Asphalt Binder PG 64-22. The asphalt concrete mix design shall conform to Asphalt Institute MS-2, sixth edition, Marshall Mix Design Method, 75 blow criteria. The mix design shall use the materials proposed for use in the work. The mix design shall be accomplished by a commercial testing laboratory conforming to the requirements of ASTM D 3666-96a.

The percentage of loss shall not be greater than 18 percent after five cycles when tested in accordance with ASTM C 88 using magnesium sulfate or 12 percent when using sodium sulfate. At least 75 percent by weight of coarse aggregate shall have at least two or more fractured faces when tested in accordance with COE CRD-C 171. Fractured faces shall be produced by crushing. The particle shape shall be essentially cubical and the aggregate shall not contain more than 20% percent, by weight, of flat and elongated particles (3:1 ratio of maximum to minimum) when tested in accordance with ASTM D 4791. Fine aggregate shall consist of clean, sound, tough, durable particles. The aggregate particles shall be free from coatings of clay, silt, or any objectionable material and shall contain no clay balls. All individual fine aggregate sources shall have a sand equivalent value not less than 45 when tested in accordance with ASTM D 2419. The fine aggregate portion of the blended aggregate shall have an uncompacted void content not less than 43.0 percent when tested in accordance with ASTM C 1252 Method A. Mineral Filler shall be nonplastic material meeting the requirements of ASTM D 242. The absorption shall be tested in accordance with State Specifications with a maximum limit of 4.0 percent.

Base course aggregates: Base course aggregates used for roads, parking lots, and other surfaced areas shall be crushed aggregate conforming to state specification subsection 1105, Type AB-1.

In addition the following requirements shall pertain:

The portion of the aggregate passing the 0.425mm sieve shall have a maximum limit on plasticity index of 5 and liquid limit of 25. The percent passing the .075mm sieve shall be between 0 to 10 percent by weight. The coarse aggregate shall not show more than 40 percent loss after 500 revolutions when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. The coarse aggregate shall not exhibit a loss greater than 18 percent weighted average, at five cycles, when tested for soundness in magnesium sulfate in accordance with ASTM C 88.

The amount of flat and elongated particles shall not exceed 20 percent for the fraction retained on the 12.5mm sieve nor 20 percent for the fraction passing the 12.5mm sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregate shall contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest mid sectional area of the face. When 2 fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Fine aggregate shall be natural sand or angular particles produced by crushing stone or gravel that meets the requirements for wear and soundness specified for coarse aggregate. The absorption shall be tested in accordance with State Specifications with a maximum limit of 4.0 percent. The Specific Gravity shall be tested in accordance with State Specifications with a minimum limit of 2.20.

The maximum density and optimum moisture content shall be determined in accordance with ASTM D 1557, Method D. Compaction shall continue until each layer has a degree of compaction that is at least 100 percent of laboratory maximum density through the full depth of the layer.

#### F. Bituminous Prime Coat

Bituminous Prime Coat shall conform to state specification section 612, and the requirements herein. Bituminous prime coat shall be: liquid asphalt conforming to the requirements of ASTM D 2027, designation MC-30 or MC-70, at the Contractor's option, except that only MC-30 shall be used on dense graded base courses if MC-70 does not adequately penetrate the base course material. In lieu of cut-back asphalt, the Contractor may use cationic emulsified asphalt conforming to the requirements of ASTM D 2397, designation CSS-1 or CSS-1h.

#### G. Bituminous Tack Coat

Unless otherwise directed or required, bituminous material shall be emulsified asphalt conforming to the requirements of ASTM D 977, designation SS-1 or SS-1h or cationic emulsified asphalt conforming to the requirements of ASTM D 2397, designation CSS-1 or CSS-1h.

H. Portland cement concrete construction: Concrete pavement construction shall conform to UFGS specification section 03300.

Steel Reinforcement for use in pavements shall conform to state specifications, and to the requirements specified in other sections.

I. Base course aggregates used for roads, parking lots, and other surfaced areas shall be crushed aggregate conforming to state

specification subsection 1105, Type AB-1.

J. Traffic Signage: Signs shall conform to state specification subsection 825.

#### 1.4 Section 02555A, PREFABRICATED UNDERGROUND HEATING/COOLING DISTRIBUTION SYSTEM

This guide specification covers the requirements for prefabricated underground distribution system for chilled water systems.

##### 1.4.1 Underground Chilled Water Piping

Underground chilled water piping shall extend from the mechanical room to the packaged, air cooled, rotary screw liquid chiller as required in Section 01016, MECHANICAL REQUIREMENTS.

##### 1.4.2 Low Temperature Hot Water and Dual Temperature Water

This guide specification also covers the requirements for prefabricated underground distribution system for low temperature hot water systems (less than 95 degrees C) and dual temperature water systems. Delete all requirements for low temperature hot water systems (less than 95 degrees C) and dual temperature water systems from this specification.

##### 1.4.3 Casing Material

Casing material shall be non-metallic and shall be as recommended by the manufacturer of the piping system for use with the carrier pipe. When different materials are provided for the casing material and the carrier pipe, the contractor shall demonstrate with manufacturer's published data that differential material expansion rates between the casing material and the carrier pipe shall not lead to product failure.

#### 1.5 Section 02556A, GAS DISTRIBUTION SYSTEM

This guide specification covers the requirements for natural or manufactured gas distribution systems designed in accordance with ASME B31.8.

##### 1.5.1 Natural Gas

The facility is to be supplied with natural gas. Delete all references to liquefied petroleum gas (LPG) or manufactured gas systems from this specification.

##### 1.5.2 Polyethylene Pipe

All underground natural gas piping shall be polyethylene pipe. Delete all references to other material types for underground gas piping from this specification.

#### 1.6 SECTION 02620, SUBDRAINAGE SYSTEM

The contractor edited specification section shall include the following material physical characteristics and performance criteria:

- A. All specification submittals shall be designated "FIO.

- B. Pipe specified shall be perforated plastic pipe.
- C. Drainage aggregate shall conform to KDOT Standard Specification Section
- D. Filter Fabric shall be

1.7 SECTION 02630, STORM DRAINAGE

1.7.1 Material and Performance Criteria

The contractor edited specification section shall include the following material physical characteristics and performance criteria:

- A. All specification submittals shall be designated "FIO".
- B. Submittals of pipe samples is not required.

1.8 SECTION 02831, FENCING

1.8.1 Material and Performance Criteria

The contractor edited specification section shall include the following material physical characteristics and performance criteria:

- A. Chainlink fabric shall be either zinc or aluminum coated 9-gage wire woven in a 50 mm mesh. Tie wires shall be 9-gage galvanized steel wire.
- B. All specification submittals shall be designated "FIO".

1.9 SECTION 02921A SEEDING and/or 02922A, SODDING

The contractor edited specification section shall include the following material physical characteristics and performance criteria:

1.9.1 Seeding and Sodding

Seed Mixture Mixture:	% Mixture	Kg per 100 Sq Meter
Turf Type Fescue		
Festuca arundinacea Bonsai	100	2.5
(turf type fescue Finelawn 8855 dwarfvarieties) Shortstop		
Tomahawk		
Monarch		
Mustang		
Twilight		
Olympic		
Hounddog		
Apache		

Notes: Any of the seed varieties listed above may be used singularly or in combination.

Total	100%	2.5 kg/100 sq meter
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Weed seed shall not exceed 1 percent by weight of the total mixture. Wet, moldy, or otherwise damaged seed shall be rejected. Seed mixing shall be performed by the seed supplier prior to delivery to the site. Minimum 85% pure live seed. Bulk quantities of seed shall be labeled.

-- End of Section --

## SECTION 02620

## SUBDRAINAGE SYSTEM

08/97

## 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 basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 478	(1996) Precast Reinforced Concrete Manhole Sections
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 3034	(1994) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F 758	(1993) Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
ASTM F 949	(1994) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-13 Certificates

Filter Fabric; GA-RE. Pipe for Subdrains; GA-RE.

Certifications from the manufacturers attesting that materials meet specification requirements. Certificates are required for drain pipe,

drain tile, fittings, and filter fabric.

SD-14 Samples

Filter Fabric; FIO-RE. Pipe for Subdrains; FIO-RE.

Samples of filter fabric, pipe, and pipe fittings, before starting the work.

### 1.3 DELIVER, STORAGE, AND HANDLING

#### 1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with minimum handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. During shipment and storage, filter fabric shall be wrapped in burlap or similar heavy duty protective covering. The storage area shall protect the fabric from mud, soil, dust, and debris. Filter fabric materials that are not to be installed immediately shall not be stored in direct sunlight. Plastic pipe shall be installed within 6 months from the date of manufacture unless otherwise approved.

#### 1.3.2 Handling

Materials shall be handled in such a manner as to insure delivery to the trench in sound undamaged condition. Pipe shall be carried and not dragged to the trench.

### 1.4 [Enter Appropriate Subpart Title Here]1.4.1 [Enter Appropriate Subpart Title Here]

## PART 2 PRODUCTS

### 2.1 PIPE FOR SUBDRAINS

Pipe for subdrains shall be of the types and sizes indicated.

#### 2.1.1 [Enter Appropriate Subpart Title Here]2.1.2 Plastic Pipe

Plastic pipe shall contain ultraviolet inhibitor to provide protection from exposure to direct sunlight.

#### 2.1.2.1 [Enter Appropriate Subpart Title Here]2.1.2.2 Polyvinyl Chloride (PVC) Pipe and Fittings

Polyvinyl chloride (PVC) pipe and fittings shall conform to ASTM D 3034, Type PSM with a maximum SDR of 35, with flexible elastomeric seal joint or ASTM F 758, Type PS 46, or ASTM F 949 for corugated sewer pipe.

#### 2.1.2.3 Pipe Perforations

Water inlet area shall be a minimum of 1,058.4 mm squared per linear meter. Manufacturer's standard perforated pipe which essentially meets these requirements may be substituted with prior approval of the Contracting Officer.

- a. Circular Perforations in Plastic Pipe: Circular holes shall be cleanly cut not more than 9.5 mm or less than 4.8 mm in diameter and arranged in rows parallel to the longitudinal axis of the

pipe. Perforations shall be approximately 76.2 mm center-to-center along rows. The rows shall be approximately 38.1 mm apart and arranged in a staggered pattern so that all perforations lie at the midpoint between perforations in adjacent rows. The rows shall be spaced over not more than 155 degrees of circumference. The spigot or tongue end of the pipe shall not be perforated for a length equal to the depth of the socket, and perforations shall continue at uniform spacing over the entire length of the pipe.

- b. Slotted Perforations in Plastic Pipe: Circumferential slots shall be cleanly cut so as not to restrict the inflow of water and uniformly spaced along the length and circumference of the tubing. Width of slots shall not exceed 3.2 mm nor be less than 0.8 mm. The length of individual slots shall not exceed 31.75 mm on 80 mm diameter tubing, 10 percent of the tubing inside nominal circumference on 100 to 200 mm diameter tubing, and 63.5 mm on 250 mm diameter tubing. Rows of slots shall be symmetrically spaced so that they are fully contained in 2 quadrants of the pipe. Slots shall be centered in the valleys of the corrugations of profile wall pipe.

## 2.2 FILTER FABRIC

Filter fabric shall be a pervious sheet of polyester, nylon, or polypropylene filaments woven or otherwise formed into a uniform pattern with distinct and measurable openings. The filter fabric shall provide an equivalent opening size (AOS) no finer than the US Standard Sieve No. 70 and no coarser than the US Standard Sieve No. 100. AOS is defined as the number of the US Standard sieve having openings closest in size to the filter fabric openings. The filaments shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of propylene, ethylene, or vinylidene-chloride, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure. The fabric shall have a minimum physical strength of 444.8 N per meter in any direction when tested in accordance with ASTM D 5034 using the grab test method with 645.2 square mm jaws and a constant rate of travel of 304.8 mm per minute. Elongation at failure shall be between 30 and 70 percent. The fabric shall be constructed so that the filaments will retain their relative position with respect to each other. The edges of the fabric shall be selvaged or otherwise finished to prevent the outer material from pulling away from the fabric.

## 2.3 DRAINAGE STRUCTURES

### 2.3.1 Concrete

Except for precast concrete, reinforcement shall conform to the requirements for 21 MPa concrete in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The concrete mixtures shall have air content, by volume of concrete, based on measurements made immediately after discharge from the mixer of 5 to 7 percent when coarse-aggregate maximum size is 38.1 mm or smaller. Air content shall be determined in accordance with ASTM C 231. The concrete covering over steel reinforcing shall be not less than 25.4 mm thick for covers and not less than 38.1 mm thick for walls and flooring. Concrete covering deposited directly against the ground shall be at least

76.2 mm thick between the steel and the ground. Expansion-joint filler material shall conform to ASTM D 1751 or ASTM D 1752. Exposed concrete surfaces, such as drainage structures that form a continuation of concrete curbs and gutters, shall be given a protective coating of linseed oil as specified in Section 02511 CONCRETE SIDEWALKS AND CURBS AND GUTTERS.

### 2.3.2 Mortar

Mortar for pipe joints and connections to other drainage structures shall be composed of one part by volume of portland cement and two parts of sand. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar. Water shall be clean and free of injurious acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes from the time the ingredients are mixed with water.

### 2.3.3 Manholes and Appurtenances

#### 2.3.3.1 Precast Reinforced Concrete Manhole Risers and Tops

Precast reinforced concrete manhole risers and tops shall conform to ASTM C 478.

### 2.4 SUBDRAIN FILTER AND BEDDING MATERIAL

Subdrain filter and bedding material shall be washed sand, sand and gravel, crushed stone, crushed stone screenings, or slag composed of hard, tough, durable particles free from adherent coatings. Filter material shall not contain corrosive agents, organic matter, or soft, friable, thin, or elongated particles and shall be evenly graded between the limits specified in TABLE I. Gradation curves will exhibit no abrupt changes in slope denoting skip or gap grading. Filter materials shall be clean and free from soil and foreign materials. Filter blankets found to be dirty or otherwise contaminated shall be removed and replaced with material meeting the specific requirements, at no additional cost to the Government.

TABLE I. FILTER GRADATION

Sieve Designation	Percent by Weight Passing
38 mm (1-1/2 inch)	100
25.0 mm (1 inch)	95-100
12.5 mm (1/2 inch)	25-60
4.75 mm (No. 4)	0-10
75um (No. 200)	0-2

### PART 3 EXECUTION

#### 3.1 EXCAVATION AND BEDDING FOR SUBDRAIN SYSTEMS

Trenching and excavation, including the removal of rock and unstable material, shall be in accordance with Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Bedding material shall be placed in the trench as indicated or as required as replacement materials used in those areas where unstable materials were removed. Compaction of the bedding material shall be as specified for cohesionless material in Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

#### 3.2 FLUSHING AND OBSERVATION RISERS

##### 3.2.1 Flushing and Observation Risers

Flushing and observation riser pipes with frames and covers shall be installed at the locations indicated. Risers shall be constructed of precast concrete or galvanized corrugated metal pipe. Joining of riser pipes to the subdrain system shall be as indicated.

#### 3.3 INSTALLATION OF FILTER FABRIC AND PIPE FOR SUBDRAINS

##### 3.3.1 Installation of Filter Fabric

###### 3.3.1.1 Overlaps on Perforated or Slotted Pipes

One layer of filter fabric shall be wrapped around perforated or slotted collector pipes in such a manner that longitudinal overlaps of fabric are in unperforated or unslotted quadrants of the pipes. The overlap shall be at least 50 mm. The fabric shall be secured to the pipe in such a manner that backfill material will not infiltrate through any fabric overlaps.

###### 3.3.1.2 Installation on Open-Joint Pipe

One layer of filter fabric shall be wrapped around open joints. The overlap should be at least 50 mm. The fabric shall be secured to the pipe in such a manner that backfill material will not infiltrate through the overlap or the edges of the fabric to either side of the open joint.

###### 3.3.1.3 Trench Lining and Overlaps

Trenches to be lined with filter fabric shall be graded to obtain smooth side and bottom surfaces so that the fabric will not bridge cavities in the soil or be damaged by projecting rock. The fabric shall be laid flat but not stretched on the soil, and it shall be secured with anchor pins.

Overlaps shall be at least 25 mm, and anchor pins shall be used along the overlaps.

### 3.3.2 Installation of Pipe for Subdrains

#### 3.3.2.1 Pipelaying

Each pipe shall be carefully inspected before it is laid. Any defective or damaged pipe shall be rejected. No pipe shall be laid when the trench conditions or weather is unsuitable for such work. Water shall be removed from trenches by sump pumping or other approved methods. The pipe shall be laid to the grades and alignment as indicated. The pipe shall be bedded to the established gradeline. Perforations shall be centered on the bottom of the pipe. Pipes of either the bell-and-spigot type or the tongue-and-groove type shall be laid with the bell or groove ends upstream. All pipes in place shall be approved before backfilling.

#### 3.3.2.2 Jointings

- a. Polyvinyl Chloride (PVC) Pipe: Joints shall be in accordance with the requirements of ASTM D 3034, ASTM D 3212, or ASTM F 949.

### 3.4 INSTALLATION OF AND BACKFILLING FOR BLIND OR FRENCH DRAINS

Filter material shall be placed as indicated and compacted as specified for cohesionless materials in Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Filter material shall extend to a suitable outlet or to an outlet through a pipeline as indicated. Overlying backfill material shall be placed and compacted as specified in Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

### 3.5 INSTALLATION OF FILTER MATERIAL AND BACKFILLING FOR SUBDRAINS

After pipe for subdrains has been laid, inspected, and approved, filter material shall be placed around and over the pipe to the depth indicated. The filter material shall be placed in layers not to exceed 200 mm thick, and each layer shall be thoroughly compacted by mechanical tampers to obtain the required density. Compaction of filter material and the placement and compaction of overlying backfill material shall be in accordance with the applicable provisions specified in Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

### 3.6 TESTS

#### 3.6.1 Pipe Test

Strength tests of pipe shall conform to field service test requirements of the ASTM specification covering the product (paragraph PIPE FOR SUBDRAINS).

-- End of Section --

## SECTION 02700

ASPHALTIC CONCRETE INTERMEDIATE LEVELING AND SURFACE COURSES  
(CENTRAL PLANT HOT MIX)**Sept/98**

## 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 basic designation only.

## AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS

T 168-91	Sampling Bituminous Paving Mixtures
T 248-84	Reducing Field Samples of Aggregate to Testing Size
T 283-89	Resistance of Compacted Bituminous Moisture to Moisture Induced Damage

## ASPHALT INSTITUTE

Manual Series No. 2 (MS-2)	Mix Design Methods For Asphalt Concrete Sixth Edition
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## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS

C 29-91	Unit Weight and Voids in Aggregate
C 88-90	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
C 117-90	Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
C 127-88	Specific Gravity and Absorption of Coarse Aggregate
C 128-88	Specific Gravity and Absorption of Fine Aggregate
C 131-89	Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
C 136-84a	Sieve Analysis of Fine and Coarse Aggregates

C 183-88	Sampling and Acceptance of Hydraulic Cement
C 566-89	Total Moisture Content of Aggregate by Drying
D 75-87	Sampling Aggregates
D 140-88	Sampling Bituminous Materials
D 242-85 (R1990)	Mineral Filler for Bituminous Paving Mixtures
D 1461-85	Test Method for Moisture or Volatile Distillates in Bituminous Paving Mixtures
D1559-89	Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
D 2041-94	Test Method for Theoretical Maximum Specific Gravity of Bituminous Paving Mixtures
D 2172-92	Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
D 2726-90	Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
D 3381-92	Viscosity-Graded Asphalt Cement for Use in Pavement Construction
D 4791-89	Flat or Elongated Particles in Coarse Aggregate
D 6307	Standard Test Method for Asphalt Content of Hot Mix Asphalt by Ignition Method
E 548	Standard Guide for General Criteria Used for Evaluating Laboratory Competence

1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-08 Statements

Testing Laboratory, para. 1.6.1; GA-RE

The following shall be in one transmittal:

Equipment, para. 2.3; GA-KC

Mixing Plant, para. 2.4 ; GA-KC

SD-09 Reports

The following shall be included in the composition of mixture transmittal

Composition of Mixture, para.'s 2.2 thru 2.2.3.1; GA-KC

Coarse Aggregate, para. 1.4.2.1.a; GA-KC

Fine Aggregate, para. 1.4.2.1.b; GA-KC

Mineral Filler, para. 1.4.2.1.c; GA-KC

#### QC PRODUCTION OF AGGREGATE

Aggregate Gradation, para. 1.4.2.2.a; GA-KC

Crushed Particle Test, para. 1.4.2.2.b; GA-KC

Specific Gravity Test, para. 1.4.2.2.c; GA-KC

SD-13 Certificates

The following shall be included in the composition of the mixture transmittal:

Bituminous Material, para. 1.5; GA-KC

### 1.3 DEFINITIONS

#### 1.3.1 General

Bituminous intermediate and surface course shall consist of fine and coarse aggregates and mineral filler uniformly mixed with hot bituminous material, and placed and compacted on a prepared base course, or intermediate course.

All quality control sampling and testing results and reports shall be included in the Contractor's Daily Quality Control Reports.

#### 1.3.2 Aggregates

Aggregates shall consist of crushed stone, crushed gravel, screenings, sand, and mineral filler. The portion of these materials retained on the 4.75 mm (No. 4) sieve shall be known as coarse aggregate; the portion passing the 4.75 mm (No. 4) sieve and retained on the 75 um (No. 200) sieve, as fine aggregate; and the portion passing the 75 um (No. 200), as mineral filler. The coarse and fine aggregates and mineral filler shall be so graded and of such character that when combined, a blend will be produced that will meet the requirements specified in subsequent paragraphs, entitled AGGREGATE GRADATION and COMPOSITION OF MIXTURE.

##### 1.3.2.1 The total aggregate

The total aggregate (coarse aggregate, fine aggregate, and the material passing the 75 um (No. 200) sieve) shall contain not less than 80 percent crushed material for intermediate course and surface course.

#### 1.3.2.2 Coarse aggregates

Coarse aggregates shall consist of clean, sound, durable fragments of crushed stone or crushed gravel meeting the following requirements:

- a. Percent of wear shall not exceed 40 after 500 revolutions, as determined in accordance with ASTM C 131-89.
- b. Percentage of loss shall not exceed 18 after five cycles performed in accordance with ASTM C 88-90, using magnesium sulfate.
- c. The dry weight of crushed slag shall not be less than 1,200 Kg/cubic m (75 pcf), as determined in accordance with ASTM C 29-91.
- d. Crushed gravel retained on the 4.75 mm (No. 4) sieve and each coarser sieve shall contain at least 80 percent by weight of crushed pieces having one or more fractured faces with the area of each face equal to at least 80 percent of the smallest mid sectional area of piece. When two fractures are contiguous, the angle between planes of fractures shall be at least 30 degrees to count as two fractured faces.
- e. Particle shape of crushed aggregates shall be essentially cubical. The quantity of flat and elongated particles in any sieve size shall not exceed 20 percent by weight, when determined in accordance with ASTM D 4791-89.

#### 1.3.2.3 Fine Aggregate

Fine aggregate shall consist of clean, sound, durable particles including natural sand or crushed stone or gravel that meets requirements for wear and soundness specified for coarse aggregate. Fine aggregate produced by crushing gravel shall have at least 90 percent by weight of crushed particles having two or more fractured faces in the portion retained on the 600 um (No. 30) sieve. This requirement shall apply to the material before blending with natural sand when blending is necessary.

#### 1.3.2.4 Mineral filler

Mineral filler shall conform to ASTM D 242-85 (R1990) and the following additional requirements. At least 50 percent of the mineral filler shall be hydrated lime, limestone dust or Portland cement. However, in areas where long service has shown that there has been no problem with stripping when the proposed aggregates are used, this additional requirement may be waived by the Contracting Officer when requested in writing.

### 1.4 SAMPLING AND TESTING OF AGGREGATES

#### 1.4.1 General

Sampling shall be performed in accordance with ASTM D 75-87 for aggregates and ASTM C 183-88 for mineral filler, unless otherwise directed. Quality control tests shall be performed at the frequency specified hereinafter. Aggregates shall not be delivered to the job site or used in the production of bituminous mixtures without prior approval.

#### 1.4.2 Preconstruction Aggregate Testing

##### 1.4.2.1 Initial tests (SD09-GA)

## Initial tests (SD09-GA)

The Contractor shall perform the following tests on the aggregates prior to designing the mix.

- a. Coarse aggregate: Wear (abrasion) test, soundness test, gradation test, and specific gravity test. A crushed particle (fractured-faces) test unless the coarse aggregate is crushed quarried rock.
- b. Fine aggregate shall be tested to determine compliance with specification requirements and gradation.
- c. Mineral filler shall be tested to determine compliance with specification requirements.

## 1.4.2.2 Quality control tests (SD09-GA)

## Quality control tests (SD09-GA)

During production, aggregates shall be sampled and tested, as required. The test results reported for these samples will be the basis of approval of specific lots of aggregates for the gradation and paving-mixture requirements. Gradation and specific gravity shall not vary significantly. The frequency of testing shall be as follows:

- a. One gradation test of aggregate for every 1,000 Metric tons (1,100 tons) of each size of aggregate as it is stockpiled.
- b. One crushed particle (fractured faces) test for every 1,000 Metric tons (1,100 tons) of each size of coarse aggregate as it is stockpiled unless the material is crushed quarried rock or unless otherwise approved.
- c. One specific gravity test for every 1,000 Metric tons (1,100 tons) of each size grouping of aggregate stockpiled.

## 1.5 BITUMINOUS MATERIALS (SD13-GA)

Bituminous material shall not be incorporated into the mix without prior approval. Bituminous materials to be mixed with mineral aggregates shall conform to the following:

## 1.5.1 Asphalt Cement

Asphalt cement shall conform to ASTM D 3381-92, viscosity grade: AC-20. A certified refinery analysis from the proposed source shall be furnished.

## 1.6 QUALITY CONTROL

## 1.6.1 General (SD08-GA)

All quality control sampling and testing shall be the responsibility of the Contractor in accordance with SECTION: CONTRACTOR QUALITY CONTROL and as specified herein. All sampling and testing shall be performed by a

commercial testing laboratory with the capability of performing all the testing specified herein and shall be supervised by a registered professional engineer. The Contractor may elect to establish testing facilities of his own. The Contractors laboratory shall have the capability of performing all the testing specified herein. Approval of such facilities shall be based on compliance with ASTM E 548 No work requiring testing will be permitted until the Contractor's facilities have been inspected and approved. The Contractors testing laboratory shall be supervised by a registered professional engineer. The first inspection of the facilities shall be at the expense of the Government and any subsequent inspections required because of failure of the first inspection will be at the expense of the contractor. Such costs will be deducted from the total amount due the Contractor. The Government may perform verification tests as considered necessary.

PART 2 PRODUCTS

2.1 AGGREGATE GRADATION

Mineral aggregate shall be of such size that the percentage composition by weight, as determined by ASTM C 136-84a and C 117-90, will generally conform to the gradation shown below for the specific course shown on the drawings. Regardless of the gradation chosen by the Contractor, it shall be his responsibility to furnish a combined aggregate which will produce a bituminous mixture meeting all requirements specified herein, particularly those specified in paragraph: COMPOSITION OF MIXTURE and any aggregate gradation which fails to produce a bituminous mixture meeting all requirements specified shall be rejected and replaced with a satisfactory aggregate gradation at no additional cost to the Government, and with no extension of time due to any delay caused by such replacement.

Percentage Passing, by Weight

Sieve Size	Intermediate Course 19.0 mm (3/4 inch) Max.	Surface course 12.5 mm (1/2 inch) Max.
25.0 mm (1 inch)	100	--
19.0 mm (3/4 inch)	95-100	100
12.5 mm (1/2 inch)	--	--
9.5 mm (3/8 inch)	70-90	79-94
4.75 mm (No. 4)	--	60-77
2.36 mm (No. 8)	28-58	44-62
1.18 mm (No. 16)	--	--
600 um (No. 30)	12-36	22-39
300 um (No. 50)	--	--
150 um (No. 100)	--	--
75 um (No. 200)	2-7	2-7

Note: The job mix formula may have to fall outside the gradation band shown above in order to meet the test properties of the mixture shown in paragraph: COMPOSITION OF MIXTURE.

2.2 COMPOSITION OF MIXTURE (SD09-GA)

2.2.1 Job-Mix Formula

The bituminous mix design shall be established by a laboratory approved as specified in paragraph: QUALITY CONTROL using the materials and properties

specified herein. Certified test results of the job-mix formula and materials shall be submitted for approval at least 30 days prior to commencing construction to the Kansas City District, Attention ED-GL. No bituminous mixture shall be produced until the job-mix formula has been approved by the Contracting Officer. The formula will indicate the percentage of each sieve fraction of aggregate, and the percentage of asphalt and temperature of completed mixture when discharged from mixer. The job-mix formula will be allowed the following tolerances.

Aggr. passing 4.75 mm (No. 4) sieve or larger	plus or minus 5%
Aggr. passing 2.36 mm (No. 8), 1.18 mm (No. 16), 600 um (No. 30), and 300 um (No. 50) sieves	plus or minus 4%
Aggregate passing 150 um (No. 100) and 75 um (No. 200)sieves	plus or minus 2%
Asphalt as determined by extraction tests	plus or minus 0.25%
Temperature of mixing	plus or minus 14 degrees C (+/- 25 degrees F)

The bitumen content and aggregate gradation may be adjusted within the limits of the tables specified herein to improve the paving mixtures, as directed. The percentages of each sieve fraction in the job-mix formula will be restricted to values such that the application of the above-listed tolerances will not cause the limits of the gradation tables to be exceeded.

NOTE: It shall be noted that when the gradation varies appreciably from the single point gradation used in the mix-design, the test properties of the mix will be out of specifications and the mix-design will have to be adjusted or redesigned. This condition can occur even though the gradation meets the tolerances specified above.

### 2.2.2 Mineral Filler and Hydrated Lime

The mixtures shall contain one percent hydrated lime by weight of the total aggregate, however this may be waived as stated in Part 1, paragraph, Mineral filler. The hydrated lime shall be added during, or ahead of, the addition of the asphalt cement. If minus No. 200 material is needed in addition to the one percent hydrated lime to comply with gradation requirements, mineral filler shall be added.

### 2.2.3 Test Properties of Bituminous Mixtures

The finished mixture shall meet the requirements described below when tested in accordance with ASTM D1559-89 and the volumetric properties of compacted paving mixtures as calculated by ASTM procedures using Chapter 4 of the Asphalt Institute's Manual Series No. 2 (MS-2). The automatic Marshall Hammer may be used when it has been calibrated with a manual hammer.

The material for the theoretical specific gravity ASTM D 2041-94 and the material for the Marshall specimens (pucks) shall be cured at 135 degrees C (275 degrees F) for 2 hours in a closed oven after the mix is produced in the laboratory. Also the plant-produced mixture shall not be tested until the mix is 2 hours old. The mixture shall not be reheated. The above procedure shall be used when the water-absorption as determined by ASTM C 127-88 and ASTM C 128-88 of any aggregate in the mixture exceeds 1.25 percent. All samples will be compacted with 50 blows of specified hammer

on each side of sample. When bituminous mixture fails to meet the requirements specified below, the paving operation shall be stopped until the cause of noncompliance is determined and corrected.

2.2.3.1 Stability, Flow and Voids

The mixture shall meet the following requirements:

Test Property	Surface Course	Intermediate Course
Stability, minimum	5300 N (1200 lbs)	5300 N (1200 lbs)
Flow, maximum, 0.254 mm (1/100-inch) units	16	16
Voids, total mix, percent (see Note 1)	3-5	3-5
% Voids in Mineral Aggregate (VMA)	(See Note 2)	
Voids filled with asphalt; percent (VFA)	65-75	65-75
The ratio of minus No. 200 material to %effective asphalt cement based on the weight of the aggregate	0.6-1.2	0.6-1.2

Note 1: The laboratory job mix formula shall have the percent voids in the total mix between 4 and 4.5 percent air voids. The voids in the total mix of the mix produced at the plant shall be continually adjusted to ensure the voids stay near the middle of the range of 3 to 5 percent.

Note 2: The minimum VMA percent shall conform to the requirements specified in Table 5.3 , Chapter 5 of the Asphalt Institute manual MS-2. To insure that the VMA is not too high, the gradation of the verified mix design behind the paver shall be adjusted to meet the requirements of the VMA as stated in Chapter 5, paragraph "Evaluation of VMA Curve" of the Asphalt Institute manual MS-2. The asphalt content should be just to the left-hand side of the low point on the VMA versus Asphalt Content percent, not on the wet@ or right-hand increasing side of the curve.

Note 3: When the absorption is high the mixture will be tender until the asphalt is absorbed into the aggregate. Therefore it may be beneficial to silo the mixture at the plant for a time. This is more important when the truck haul is short.

c. Reduction in strength by saturation with water: The index of retained strength must be greater than 75 percent as determined by AASHTO T 283-89. Specimens shall be conditioned by freezing and thawing. When the index of retained strength is less than 75, the aggregate stripping tendencies may be countered by the use of hydrated lime or by treating the bitumen with an approved anti stripping agent. The hydrated lime is considered as mineral filler and should be considered in the gradation

requirements. The amount of hydrated lime or anti stripping agent added to bitumen shall be sufficient, as approved, to produce an index of retained strength of not less than 75 percent. No additional payment will be made to the Contractor for addition of anti stripping agent required.

- d. Extraction test shall be performed using ASTM D 2172-92 or D 6307.

#### 2.2.4 Sampling, Testing, and Approval of Bituminous Mixtures During Construction:

##### 2.2.4.1 General

Samples of plant mixtures shall be taken to determine conformance to the specified test properties of bituminous mixtures and to determine bitumen content and aggregate gradation. Quality Control sampling and testing shall be performed by the same testing laboratory that established the mix design. The Quality Control laboratory shall be approved as specified in paragraph: QUALITY CONTROL and as specified herein. All tests shall be performed expeditiously and results immediately furnished to the Contractor and Government representatives at the construction site or mixing plant. As a minimum the test results shall be reported on a form similar to the form "ASPHALTIC CONCRETE TEST" attached at the end of this Specification Section. Back up calculations shall be available at the laboratory and submitted in the project final report. If the mixture is out of specification or near the specified limits, the test report shall contain recommendations of how to correct the mix proportions. Construction operations shall cease when test results are not received and adjustments made within six hours after the mix comes out of the plant. The Government may perform verification tests as considered necessary. Mixtures that do not conform to the specified test properties shall be rejected. No payment will be made to the Contractor for mixtures rejected, for additional retesting, or for pavements or portions of pavement removed. T 168-91 Sampling Bituminous Paving Mixtures and T 248-84 Reducing Field Samples of Aggregate to Testing Size are to be used for sampling.

##### 2.2.4.2 Testing frequency

a. One gradation test of hot bin material for conventional plants, or total aggregate material from the final feed belt for the dryer-drum mixer for dryer-drum plants, for each 500 Metric tons (550 tons) of hot mix produced. A minimum of two tests per day and a maximum of three tests per day during hot mix production will be required.

b. Two gradation tests of hot bin material for conventional plants, or total aggregate material from the final feed belt for the dryer-drum mixer for dryer-drum plants, during trial runs performed 10 days before start of production of paving mixtures. Additional tests may be directed by the Contracting Officer when necessary to adjust the plant.

c. Marshall tests: In order to verify the mix design the first set (3 specimens) of tests shall be taken when the plant has produced approximately 75 Metric tons (82.5 tons) of hot mix. Testing shall be repeated until the tests verify that the hot mix produced meets all the properties specified in paragraph: Test properties of bituminous mixtures.

After verification of the mix one set (3 specimens) of tests shall be made for each 300 Metric tons (330 tons) of hot mix produced, except that a minimum of two sets per day and a maximum of four tests per day, shall be made. Test shall be taken from the placed bituminous mixture prior to

compaction. Material for the sample shall be taken from the following locations; one each side of the placed bituminous mat and one in the center of the mat. A square pointed shovel shall be used for taking the sample and for evenly laying material back into the disturbed mat.

d. Extraction tests shall be made to determine bitumen content and aggregate gradation at the same frequency specified above for Marshall Tests. Gradation test shall also be made when new aggregate is delivered to the plant.

NOTE: The results of the gradation test is very important in determining how to adjust the mix. After the gradation or the bitumen content has been adjusted to obtain the properties of the mix, this verified mix design becomes the project mix design. The plant settings may have to be adjusted again whenever the gradation of the materials change. When a change is made it shall be reported on the Marshall Test Report form.

e. Paving shall stop and the mixture shall be redesigned whenever any of the following occurs; three consecutive sets of Marshall tests show the percent voids in the total mix are less than 3 percent or more than 5 percent; two consecutive sets of Marshall tests show the percent voids in the total mix are less than 2 percent; two consecutive Marshall tests show the voids filled with asphalt exceed 79 percent.

f. Retained strength tests: One set of tests shall be made for the first day's construction and thereafter whenever there is any change in materials or job-mix formula.

g. Moisture tests: The bituminous mixture shall be sampled and tested for moisture in accordance with ASTM D 1461-85 each time a gradation test is performed. Tests shall be taken from the placed bituminous mixture prior to compaction. Additional test shall be made when a significant change in the stockpiles occurs such as rain, delivery of new aggregates, or when visual inspections of the mix leaving the plant show segregation of asphalt resulting from escaping water vapor in the prepared mixture.

h. Sampling, testing, and approval of bituminous materials: During construction the Contractor shall furnish asphalt samples and certified test analysis for each shipment of material delivered to the project. The Government may perform verification tests as considered necessary. During construction, the Contractor shall furnish samples of each shipment of bituminous material received at the project and the samples will be tested and/or retained by the Government for record purposes until the completion of the contract. Sampling shall be in accordance with ASTM D 140-88.

### 2.3 APPROVAL OF PLANT, EQUIPMENT, MACHINES, AND TOOLS (SD08-GA)

All equipment used shall be subject to approval. Tentative approval of specific items shall be obtained before start of operations. Final approval will be given only after full-scale production has begun. All plant equipment, tools and machines used in the work shall be maintained in a satisfactory working condition at all times.

### 2.4 MIXING PLANTS (SD08-GA)

Mixing plants shall meet the requirements of the State's Department of Transportation's latest specification in effect when this project contract is awarded to the Contractor, except the temperature of the asphalt shall not exceed 162.8 degrees C (325 degrees F) at anytime and the mixture discharged from the plant shall not exceed 148.9 degrees C (300 degrees F), or shall conform to the requirement hereinafter. The plant may be either a weigh-batch type or a continuous-mixing type of conventional plant or a dryer-drum mixing type plant provided the equipment has demonstrated suitability for producing finished mixtures similar to those required by these specifications. The plant shall have a suitable capacity to accomplish the work. Plants shall conform to subparagraph: Requirements for all plants, except that scale requirements apply only when weight proportioning is used, and in addition, shall conform to subparagraph: Special requirements for batch-mixing plants or special requirements for conventional continuous-mixing plants, below, as applicable.

#### 2.4.1 Requirements for All Plants

These requirements apply to dryer-drum mixing process plants only as specifically referenced hereinafter.

##### 2.4.1.1 Plant scales

Plant scales for any weigh box or hopper shall be of standard make and design, either of the beam or the springless-dial type and shall be sensitive to 0.5 percent of the maximum load required. Beam-type scales shall have a separate beam for each size aggregate, with a single telltale actuated for each beam, and a tare beam for balancing the hopper. Standard test weights accurate to plus or minus 0.1 percent shall be provided for checking plant scales

##### 2.4.1.2 Equipment for preparation of bituminous material

Tanks for storage of bituminous material shall be capable of heating the material, under effective and positive control at all times, to the temperatures specified herein. Heating shall be accomplished by steam coils, hot oil or electricity. Continuous circulation between storage tank and mixer during the entire operating period shall be provided. Pipelines and other bituminous handling equipment shall be stream-jacketed or otherwise properly insulated to prevent heat loss. The storage-tank capacity shall be sufficient for at least a 1-day run.

##### 2.4.1.3 Feeder for dryer

The plant shall be provided with adjustable mechanical feeders that feed each aggregate individually and in ratios required. Feeders shall have accurate and separate adjustments for proportioning each aggregate to be incorporated into the mix. Gates or other proportioning devices shall have locks for fastening the devices in any desired position. A separate bin or compartment shall be provided for each aggregate to be fed into the dryer.

##### 2.4.1.4 Rotary dryers

shall be provided in sufficient numbers to heat and dry the aggregates to the temperature and the moisture content specified herein.

##### 2.4.1.5 Plant screens

shall be capable of screening dry aggregate output of the dryers to the sizes required for proportioning into the mix. The screen sizes shall be such as to properly fractionate the aggregates so that the total aggregate

mixture may be controlled within the tolerances of the job-mix formula at operating capacity.

#### 2.4.1.6 Bins

Bins of sufficient capacity to continuously supply the mixer when it is operating at full capacity shall be provided. The bins shall be divided into at least three compartments, arranged to insure separate and adequate storage of appropriate fractions of the aggregate. Each compartment shall be provided with an overflow pipe of such size and at such location as to prevent any backing up of material into other bins. Approved dry storage shall be provided for mineral filler; and provisions shall be made for accurately weighing or proportioning the mineral filler to the mixtures. Each aggregate bin shall be equipped with mechanical or electrical telltales to indicate when the aggregate in the bin is below the level that will permit accurate proportioning of the aggregate to the mixing unit. Each bin shall be constructed or equipped in such manner that a representative sample of hot aggregate may be readily and safely taken from each bin during plant operations.

#### 2.4.1.7 Bituminous control unit

Satisfactory means, incorporating either weighing, metering, or volumetric measurements, shall be provided to obtain the required percentage of bitumen in the mix within the tolerances specified. When the quantity of bitumen is controlled by metering, provision shall be made whereby the amount of bitumen delivered through meter can be readily checked by weight.

#### 2.4.1.8 Thermometric equipment

An armored thermometer with a range of 93.3 to 204.4 degrees C (200 to 400 degrees F) shall be fixed in the bituminous feed line near the discharge valve at the mixture unit. The plant shall be further equipped with an approved recording dial-scale, a mercury-actuated thermometer, or an electric pyrometer so placed at the discharge chute of the dryer as to register automatically or indicate the temperature of the heated aggregate.

#### 2.4.1.9 Control of mixing time

Unless otherwise directed, the plant shall be equipped with positive means for governing and maintaining time of mixing constant. Interval of mixing shall be in accordance with subparagraphs: Mixer unit for batch method and Mixer unit for continuous method, specified below.

#### 2.4.1.10 Dust collectors

The plant shall be equipped with dust collectors. Provisions shall be made to waste collected material or to return all or any part of the collected material uniformly to the mixture, as directed.

### 2.4.2 Special Requirements for Batch-Mixing Plants

#### 2.4.2.1 Weigh box or hopper

Equipment shall include means for accurately weighing each bin size of aggregate in a weigh box or hopper suspended on scales, and these weigh boxes or hoppers shall be ample in size to hold a full batch without running over. The gates on both the bins and hoppers shall be constructed to prevent leakage of aggregate when closed. On manually operated plants,

an interlocking device shall be provided to prevent opening more than one gate at a time. On automatic plants designed for simultaneous weighing of all sizes of aggregate, this provision does not apply while the plant is operating under automatic control.

#### 2.4.2.2 Weigh bucket

The bitumen bucket shall have sufficient capacity to hold not less than 10 percent in excess of the weight of the bitumen required for one batch. The bitumen bucket shall be suspended on dial or beam scales equipped with a telltale so that the tare weight of the bucket will be shown for each weighing, and the net weight of the bituminous material will be measured within plus or minus 1 percent of the weight required. Use of a volumetric-metering-type device that will proportion the bitumen into the mix with the above accuracy will be permitted. The bucket shall be so arranged that the heated bituminous material will be delivered in a thin, uniform sheet, or in multiple streams the full width of the mixer, except in the case of a mixer where bituminous material is sprayed.

#### 2.4.2.3 Mixer unit for batch method

The mixer shall be an approved twin-pug mill capable of producing a uniform mixture within job-mix tolerance specified. Batch capacity of the mixer shall be suitable to accomplish the work. The mixer shall have a time lock, accurate within five seconds, to control operation of the complete mixing cycle by locking the weigh-box gate after the mixer is charged until closing of the mixer gate at the completion of the cycle. The time lock shall lock the bitumen bucket throughout the dry-mixing period and shall lock the mixer gate throughout the dry and wet-mixing periods. The dry-mixing period is defined as the interval of time between opening of the weigh-box gate and application of bituminous material and opening of the mixer gate. Control of the time shall be flexible and capable of being set at intervals of not more than 5 seconds throughout cycles up to 3 minutes. A mechanical batch counter shall be installed as part of the timing device and shall be designed to register only the actuation of the bituminous-bucket release and to preclude register of any dry batches, or the register of any material through the operation of pulling bins. If not enclosed, the mixer box shall be equipped with an adjustable hood to prevent loss of mineral filler by dispersion. The clearance of the blades from all fixed parts shall not exceed 19.1 mm (3/4-inch).

#### 2.4.3 Special Requirements for Conventional Continuous-Mixing Plants

##### 2.4.3.1 Gradation control unit

The plant shall include means for accurately proportioning each bin size of aggregate either by weighing or measuring volumetrically. When gradation control is by volume, the unit shall include a feeder mounted under the compartment bins. Each bin shall have an accurately controlled, lockable gate for volumetrically measuring material to be drawn from it. Indicators shall be provided on each gate to show the gate opening in inches.

##### 2.4.3.2 Weight calibration of aggregate feed

The plant shall include means for calibration of gate openings by weight of test samples. The materials fed out of the bins through the individual orifices shall be bypassed to suitable test boxes. The plant shall be equipped to handle conveniently such test samples weighing approximately 181.4 Kg (400 pounds) combined weight of samples from bins, and not less

than a 45.4 Kg (100 pounds) sample from any one bin. The size of the sample may be increased to 362.9 Kg (800 pounds) when so directed. A platform scale having sufficient capacity to accurately weigh the samples shall be provided. Mechanical means shall be provided to accurately proportion the mineral filler to the mixing plant.

#### 2.4.3.3 Synchronization of aggregate and bitumen feed

Approved means shall be provided for interlocking control between flow of aggregate from bins and flow of bitumen from meter or other proportioning device.

#### 2.4.3.4 Mixer

unit for continuous method shall be of an approved twin-pug mill type capable of producing a uniform mixture within the job-mix tolerances specified. Blades shall be adjustable for angular position on the shafts and reversible to retard the flow of the mix. The mixer shall bear a manufacturer's plate indicating the net volumetric contents of the mixer at the several heights inscribed on a permanent gate and the rate of feed of aggregate per minute of plant-operating speed. Unless otherwise required, determination of mixing time shall be by weight method, using the following formula.

$$\text{Mixing time in seconds} = \frac{\text{pug mill dead capacity in pounds}}{\text{pug mill output in pounds per second}}$$

Weights for the job will be determined by tests made by the Contracting Officer.

#### 2.4.3.5 Discharge hopper

The pug mill shall be equipped with a discharge hopper having a capacity of approximately 910 Kg (1 ton). The hopper shall be equipped with dump gates that permit rapid and complete discharge of the bituminous mixture without segregation.

#### 2.4.4 Requirements for Dryer-Drum Mixing Plants

Dryer-drum mixing plants shall conform to the following requirements. Equipment for preparation of bituminous material; feeder for dryer; thermometric equipment; and safety requirements shall be as specified in paragraph: REQUIREMENT FOR ALL PLANTS.

##### 2.4.4.1 Aggregate supply and control

At least two aggregate storage bins shall be furnished and used to feed at least two separate sizes of aggregate. Each bin shall have the feed rate controlled by a variable speed belt, or a remotely operated gate, calibrated to accurately deliver any specified quantity of material. The feed rate from each bin shall be readily adjustable from the control panel to change aggregate proportions of aggregate from each bin when the combined aggregate delivery is increased or decreased. The combined aggregate belt feeding type dryer-drum shall be equipped with an approved belt scale. The belt scale shall operate automatic controls which will maintain the established proportion of the bitumen and the total aggregate, with provisions for readily changing the proportions. Approved means shall be provided for storing, metering, and feeding mineral filler as a separate material when a separate mineral filler is necessary.

#### 2.4.4.2 Bituminous control unit

Approved means shall be provided to inject the required percentage of bitumen in the mix within the tolerances provided. Injection shall be so designed and controlled that no detrimental effect takes place from too close contact with dryer flame. Control of the quantity of bitumen injected shall be automatically linked to the aggregate feed scales as specified in the previous subparagraph. Provision shall be made so the amount of bitumen delivered can be checked by weight. Approved steam-jacketing or other insulation for maintaining the required temperature of bitumen in pipelines, meters, spray nozzles, etc., shall be provided. The system shall be capable of maintaining a continuous circulation of bituminous material.

#### 2.4.4.3 Dryer-drum mixer

The dryer-drum mixer shall be an approved unit specially made for such operation by a manufacturer regularly engaged in production of such units and shall be a model which has a satisfactory record of use on previous jobs. Capacity shall be sufficient to supply the work under this contract without delay to any part of the construction operations. The unit shall be capable of effectively heating and drying the mineral aggregate as required and of effectively and completely combining the bitumen and all other materials into a uniform mixture with all aggregate particle thoroughly coated. Approved means shall be provided to maintain a constant rate of rotation of the dryer drum. The unit shall be equipped with automatic burner controls and shall provide approved means for temperature sensing of the bituminous mixture at discharge.

#### 2.4.4.4 Holding bins

An approved holding bin or bins shall be provided to receive the hot bituminous mixture as it discharges from the mixer.

### 2.5 OTHER EQUIPMENT

#### 2.5.1 Bituminous-Materials Spreaders

Bituminous-materials spreaders shall be the self-propelled type equipped with hoppers, tamping, or vibrating devices, distributing screws, adjustable screeds operated either manually or automatically, equipment for heating the screeds and equalizing devices. The spreader shall be capable of spreading hot bituminous mixtures without leaving indented areas, tearing, shoving, or gouging and capable of producing a finished surface conforming to the smoothness requirements specified hereinafter. The spreader shall be capable of spreading hot bituminous mixtures without leaving indented areas, tearing, shoving, or gouging and capable of confining edge of strips to true lines without use of stationary side forms and capable of placing the course to the required thickness. If an automatic grade control device is used on the spreader for two-lane paving operations, it shall consist of sensing device for control of one end of the screed and a slope-control mechanism for control of the other end of the screed, or a sensing device on each side of the paving machine. Where the paver is used on multiple paving lanes (more than two paving lanes),

sensing devices shall be used on each side of the spreader for control of the screed. The slope-control mechanism shall not be used for grade control in multiple paving lane operations.

#### 2.5.2 Steel-Wheel Rollers

Steel-wheel rollers shall be self-propelled, three-wheel, (two-axle) and tandem (two-axle) types, weighing not less than 9,071.8 Kg (20,000 pounds) each. The three-wheel rollers shall have a minimum weight of 136 Kg per mm of width (300 pounds per inch of width) of rear wheel. Wheels shall be equipped with adjustable scrapers, water tanks, and sprinkling apparatus for keeping the wheels wet; thereby preventing the bituminous mixture from sticking to the wheels. Rollers shall be capable of reversing without backlash and free from worn parts. Roller wheels with flat and pitted areas or protections that leave marks in the pavement will not be permitted. Three-axle tandems will be permitted in lieu of two-axle tandems if approved by the Contracting Officer.

#### 2.5.3 Heavy Pneumatic-Tired Rollers

Heavy pneumatic-tired rollers shall be self-propelled and shall consist of two axles on which are mounted multiple pneumatic-tire wheels in such manner that the rear group of wheels will not follow in the tracks of the forward group but spaced to give essentially uniform coverage with each pass. Axles shall be mounted in a rigid frame provided with a loading platform or body suitable for ballast loading. Tires shall be smooth and capable of being inflated to at least 621 KPa (90 p.s.i.) Construction of the roller shall be such that each wheel can be loaded to a minimum of 2,040 Kg (4,500 pounds).

#### 2.5.4 Blowers and Brooms

Blowers and brooms shall be power type and suitable for cleaning the surface to be paved.

#### 2.5.5 Saw and Core Drill

Saw and core drill shall be of the power type. The saw shall be capable of rapidly cutting pavement samples and trimming joints and edges of pavement.

The core drill used for obtaining pavement samples shall be equipped with a diamond, tungsten carbide, or other bit capable of rapidly cutting a precision core sample 101.6 mm (4 inches) in diameter.

#### 2.5.6 Small Tools

Small tools shall consist of rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heater for heating small tools, stilt sandals, and other small tools in numbers as required.

### PART 3 EXECUTION

#### 3.1 WEATHER LIMITATIONS

Bituminous courses shall be constructed only when the base course or intermediate course is dry and when the weather is not rainy. Unless otherwise directed, asphalt courses shall not be constructed when the temperature of the surface of existing pavement or base course is below 4.4 degrees C (40 degrees F).

### 3.2 PREPARATION OF SURFACE

#### 3.2.1 Bituminous mixtures

shall not be placed with-out ample time to complete spreading and rolling during daylight hours, unless approved satisfactory artificial lighting is provided. Immediately prior to placing the bituminous base or surface course, all loose material, dirt, clay, or other objectionable material shall be removed from the surface.

#### 3.2.2 If the surface of the underlying material

has been damaged after placement or has inadequate compaction (soft spots) or other deviations from this contract specification requirements, such defects shall be repaired immediately prior to placement of the bituminous course. Trucks delivering materials shall be routed in a manner to minimize traveling over the subgrade during the placement operation. Paving operations shall be conducted in such a manner to prevent runoff water from being ponded on the subgrade in case of rain.

### 3.3 GRADE CONTROL

The lines and grades shown on the contract drawings shall be established and maintained by means of line and grade stakes placed at the site of the work by the Contractor in accordance with CONSTRUCTION CLAUSE: LAYOUT OF WORK. Elevations of bench marks used by the Contractor for controlling pavement operations at site of work will be determined, established, and maintained by the Government. Finished pavement gradelines and elevations shown shall be established and controlled at site of work by the Contractor in accordance with bench mark elevations furnished by the Contracting Officer.

### 3.4 MIXING

The bituminous mixtures shall be produced in a plant as specified hereinafter.

#### 3.4.1 Conventional Plant

##### 3.4.1.1 Preparation of mineral aggregates

Each component of various-sized aggregates blended in preparation of the bituminous mixture shall be placed and maintained in separate stockpiles. Various-sized aggregates shall be stockpiled to prevent segregation or intermixing. Bulldozers shall not be used for stockpiling aggregates or feeding aggregates to plant. The aggregate shall be fed into the cold elevator by separate mechanical feeders in a manner that will produce an aggregate graded within the requirements of the job mix formulas and tolerances specified. The aggregates shall be heated and thoroughly dried before entering the hot bins. The temperature and moisture content of the aggregate determined as it enters the mixer shall be uniform and such that the temperature and moisture content of the finished mixture will be uniform and within the tolerances specified. The heated and dried aggregates shall be screened and conveyed to separate hot bins ready for mixing with the bituminous material. The aggregate shall be separated into the sizes designated or approved, except that hot aggregate shall be

separated into not less than three sizes. Approved dry storage shall be provided for mineral filler.

#### 3.4.1.2 Preparation of bituminous mixtures

Each size of aggregate, prepared as specified herein before, and dry mineral filler shall be accurately weighed or measured and conveyed into the mixer in the proportionate quantities required to meet the job-mix formula. The required amount of asphalt for each batch or calibrated amount for continuous mixing, shall be introduced into the mixer. In batch mixing, after the aggregates and mineral filler have been introduced into the mixer and mixed for not less than 5 seconds, the asphalt shall be added and the mixing continued for not less than 20 seconds and as much longer as may be required to obtain a homogeneous mixture. When a continuous mixer is employed, the mixing time shall be not less than 25 seconds, and as much longer as may be required to obtain a homogeneous mixture. Additional mixing time when required will be determined by the Contracting Officer. In no case shall the aggregate be introduced into the mixer at a temperature more than (-) 4 degrees C (25 degrees F) above the temperature of the asphalt. The temperature of the asphalt at the time of mixing shall not exceed 163 degrees C (325 degrees F). The temperature of the aggregate and mineral filler in the mixer shall not exceed 177 degrees C (350 degrees F) when the asphalt is added. However, the temperature discharged from the plant shall not exceed 149 degrees C (300 degrees F). The temperatures of both the aggregate and asphalt at the time of mixing and the additional mixing time required shall be as determined by the Contracting Officer. When the mixture is prepared in a twin-shaft pug mill mixer, the volume of the aggregates, mineral filler, and asphalt shall not be so great that the mixture extends above the tips of the mixer blades when the blades are in a vertical position. All overheated and carbonized mixtures or mixtures which foam or show indications of moisture will be rejected. When moisture is detected in the finished mixture, all aggregate in the bins shall be removed immediately and returned to the respective stockpiles.

#### 3.4.1.3 Water content of aggregates

During drying operations, the water content shall be reduced to less than 0.25 percent for aggregate blends with water absorption of 2.5 percent or less, and to less than 0.50 percent for aggregate blends with water absorption greater than 2.5 percent, absorption to be determined by ASTM C 127 and C 128. The water absorption for the aggregate blend shall be the weighted average of the absorption value for the coarse aggregate and the fine aggregate. The water content test shall be conducted in accordance with ASTM C 566-89. Water content for the blend will be a weighted average based on the composition of the blend.

#### 3.4.2 Dryer-Drum Mixer

##### 3.4.2.1 Preparation of mineral aggregates

The mineral aggregate shall be furnished in at least two separate sized materials. Each component of the various-sized aggregates to be blended in preparation of the bituminous mixture shall be placed in separate stockpiles in such manner that the separate sizes will not be intermixed and that segregation does not take place. Each size shall be stored in a separate bin without mixing, for feeding the dryer-drum mixer. The aggregate shall be fed into the dryer-drum mixer by the equipment previously specified in such manner that will produce a total aggregate graded within the requirements of the job-mix formula and tolerances

specified. Moisture content of the aggregates fed to the dryer-drum mixer shall be as necessary to produce a bituminous mixture meeting all specified requirements.

#### 3.4.2.2 Preparation of bituminous mixture

The aggregates and mineral filler shall be accurately weighed using the specified equipment and conveyed to the dryer-drum mixer in amounts required to conform to the job-mix formula. The required amount of asphalt shall be continuously injected into the dryer-drum mixer with the aggregate in the amount required by the job-mix formula, using the injection and control equipment previously specified. The temperature of the asphalt shall not exceed 163 degrees C (325 degrees F) at any time. The temperature of the bituminous mixture as discharged from the dryer-drum mixer shall not exceed 149 degrees C (300 degrees F). The speed of rotation of the drum, the temperature within the drum and time the mixture is within the drum shall be controlled so as to produce a uniform bituminous mixture without segregation and with all aggregate particles thoroughly coated and conforming to all requirements of these specifications. All overheated and carbonized mixtures shall be rejected. Particular care shall be taken when commencing operations each day to reject any bituminous mixture that does not meet all requirements of these specifications.

#### 3.4.2.3 Moisture test

Absorbed moisture in the aggregate shall be reduced to such a quantity that there is no objectionable segregation of asphalt resulting from escaping water vapor in the prepared mixture. A maximum of 0.5 percent moisture based on weight of the mixture, will be allowed in the mixture when sampled behind the paver and tested in accordance with ASTM D 1461.

### 3.5 TRANSPORTATION OF BITUMINOUS MIXTURE

The bituminous mixture shall be transported from the mixing plant to the site in trucks having tight, clean, smooth beds coated with a minimum amount of a concentrated solution of hydrated lime and water to prevent adhesion of the mixture to the truck beds. Each load of mixture shall be covered with canvas, or other suitable material of ample size to protect the mixture from the weather and to prevent loss of heat. Deliveries shall be scheduled so that spreading and rolling of all mixture prepared for one day's run can be completed during daylight unless approved adequate artificial lighting is provided. The mixture shall be delivered in such manner that the temperature at the time of dumping into the spreader will be not less than hereinafter specified. Loads that have crusts of cold, unworkable material or have become wet by rain will be rejected. Hauling over freshly placed material will not be permitted.

### 3.6 PLACING

Intermediate course, or any layer of surface course shall not be left uncovered by the subsequent course for more than 5 days, weather permitting. Material trucks hauling materials other than asphaltic concrete or tack coat shall not travel on previously constructed layers of asphaltic concrete until the final surface course is constructed.

#### 3.6.1 Surface Preparation of Underlying Course

Prior to placing of the intermediate or surface course, the underlying

course shall be cleared of all foreign or objectionable matter with power blowers, power brooms, or hand brooms. A tack coat shall be applied between the intermediate and surface course mixture. The tack coat between layers of recently constructed inter-mediate course, or layers of recently constructed surface course, may have the application rate reduced when specifically approved if the surface of the previously placed layer as approved is entirely free of dust, dirt or other foreign matter which might reduce the bond between the layers of the intermediate or surface course. Tack coat shall not be completely omitted.

### 3.6.2 Offsetting Joints in Intermediate and Surface Courses

The surface course shall be placed so that longitudinal joints of the surface course will not coincide with joints in the intermediate course by approximately 230 mm (9 inches). Care shall be taken when possible to offset longitudinal joints in a manner that the final surface course joint is in the center of the pavement or on a lane line. Transverse joints in the surface course shall be offset by at least two feet from transverse joints in the intermediate course.

### 3.6.3 General Requirements for Use of Mechanical Spreader

The range of temperatures of the mixture, when dumped into the mechanical spreader shall be as determined by the Contractor. Asphalt mixtures having temperatures less than 113 degrees C (235 degrees F) when dumped into a mechanical spreader will be rejected. The mechanical spreader shall be so adjusted and its speed so regulated that the surface of the course being placed will be smooth and continuous without tears and pulling, and of such depth that, when compacted, the surface will conform with the cross section, grade, and contour shown on the drawings. Unless otherwise directed, placing shall begin along the centerline of areas paved on a crowned section or on the high side of areas with a one-way slope, and shall be in the direction of the major traffic flow. The mixture shall be placed in consecutive adjacent strips having a minimum width of 3.05 meters (10 feet), except when edge lanes require strips less than 3.05 meters (10 feet) to complete an area. Each strip placed before a succeeding strip shall be of such length that sufficient heat will be retained to make the strip readily compactible so that a joint can be obtained conforming to the requirements for texture, density, and smoothness specified in the paragraph: JOINTS. The length of any strip to be laid prior to the succeeding strip shall be as directed and may be decreased or increased as dictated by changes in climatic conditions. Longitudinal joints and edges shall be constructed to true line markings. The Contractor shall establish lines parallel to the centerline of the area to be paved and shall place string lines coinciding with established lines for the spreading machine to follow. Number and location of lines shall be as directed. Placing of the mixture shall be as nearly continuous as possible, and the speed of placing shall be adjusted, as directed, to permit proper rolling.

#### 3.6.3.1 Special Procedures to Prevent Segregation

The wings of the spreader hopper shall not be emptied (flipped) between truck loads. The screed auger shall be operated approximately three-fourths (3/4) full and the hopper conveyor shall not be allowed to run out of material.

#### 3.6.4 Special Requirements for Placing Strips Succeeding Initial Strips

In placing each succeeding strip after the initial strip has been spread and compacted as specified hereafter, the screed end gate of the mechanical spreader shall overlap the previously placed strip slightly and shall be 1.25 times thicker than the existing compacted strip in order to produce a smooth compacted joint with the specified density. Mixture placed on the edge of the previously placed strip by the mechanical spreader shall be pushed back (tucked) to the edge of the strip being placed by use of a lute (rake). The pushed back material shall form a ridge on the uncompact strip along the edge of the previously placed strip. The height of the ridge above the uncompact strip should be approximately equal to the thickness being allowed for roll down during compaction. Procedures similar to these outlined above shall be used to facilitate getting a smooth joint with density. When the quantity of mixture on the previously placed strip plus uncompact material in the strip being placed exceeds that required to produce a smooth, dense joint, the excess mixture shall be removed and wasted. Excess material shall not be spread over the uncompact mat.

### 3.6.5 Shoveling, Raking, and Tamping After Machine Spreading

A sufficient number of experienced shovelers and rakers shall follow the spreading machine, adding hot mixture and raking the mixtures as required to produce a course that, when completed, will conform to all requirements specified herein. Broadcasting or fanning of mixture over areas being compacted will not be permitted. When segregation occurs in the mixture during placing, the spreading operation shall be suspended until the cause is determined and corrected. Irregularities in alignment of the course left by the mechanical spreader shall be corrected by trimming directly behind the machine. Immediately after trimming, the edges of the course shall be thoroughly compacted by tamping laterally with a lute. Distortion of the course during tamping will not be permitted.

### 3.6.6 Hand Spreading in Lieu of Machine Spreading

In areas where the use of machine spreading is impractical, the mixture shall be spread uniformly with hot shovels and hot rakes in a loose layer of a thickness that, when compacted, will conform to the required grade and thickness. During hand spreading, each shovelful of mixture shall be carefully placed by turning the shovel over in a manner that will prevent segregation. In no case shall the mixture be placed by throwing or broadcasting from a shovel. The loads shall not be dumped faster than can be properly handled by the shovelers and rakers.

## 3.7 COMPACTION OF MIXTURE

### 3.7.1 General

Compaction of the mixture shall be accomplished using a minimum of 2 steel-wheel rollers and a pneumatic-tired roller specified above. Rolling shall begin as soon after placing as mixture will bear roller without undue displacement. Delays in rolling freshly spread mixture will not be permitted. After initial rolling, preliminary tests of crown, grade, and smoothness shall be made by the Contractor under supervision of the Contracting Officer. Before rolling is continued, deficiencies shall be corrected so that finished course will conform to requirements for grade and smoothness specified herein. Further smoothness checks shall be made by the Contractor as directed by the Contracting Officer. After preliminary smoothness tests, rolling shall be continued until density is obtained in all portions of each course of not less than 95 percent of

density of laboratory compacted Marshall specimens taken behind the paver.

### 3.7.2 Density Tests

Density of the compacted mixture of the surface or intermediate course shall be determined by tests made on specimens taken from the compacted course in accordance with the requirements of paragraph: SAMPLING PAVEMENTS. Specimens shall be tested in accordance with the requirements of ASTM D 2726-90.

### 3.7.3 Operation of Rollers, Tampers and Vibro Plate Compactors

#### 3.7.3.1 The speed of rollers

shall be slow enough at all times to avoid displacement of the hot mixture. Displacement of the mixture resulting from reversing the direction of the roller or from any other cause shall be corrected at once by use of rakes, and fresh mixture shall be applied or removed when necessary. Alternate passes of the roller shall be varied slightly in length. During rolling, the wheels of steel-wheel rollers and plates of vibro plate compactors shall be moistened to prevent adhesion of the mixture to the wheels or plates, but excess water will not be permitted. Tires of heavy pneumatic roller shall be moistened with soapy water when required to prevent mixture from sticking to tires during rolling. Rollers shall not be permitted to stand on finished courses until the courses have thoroughly cooled. The minimum number of rollers shall be adequate to obtain the specified density. Places inaccessible to rollers shall be thoroughly compacted with hot hand-tampers or vibro plate compactors.

#### 3.7.3.2 Unless otherwise directed by Contracting Officer,

a pneumatic-tired roller shall be used as an intermediate roller. Longitudinal joints shall be pinched to ensure compaction with the pneumatic-tired roller. The roller shall make at least one complete pass (forward and backward) operated on the hot lane as the intermediate roller. The roller shall be operated with its outside tire as close as possible to the previously placed lane.

### 3.7.4 Correcting Deficient Areas

Mixtures that become contaminated or are defective shall be removed. Skin patching of an area that has been rolled will not be permitted. Holes the full thickness of the course shall be cut so that the sides are perpendicular and parallel to the direction of traffic and the edges are vertical. Edges shall be sprayed with bituminous materials conforming to the requirements of SECTION: BITUMINOUS TACK COAT. Sufficient fresh paving mixture shall be placed in the holes so that finished surface will conform to the grade and smoothness requirements. The paving mixture shall be compacted to the density specified herein.

## 3.8 JOINTS

### 3.8.1 General

Joints between old and new pavements or between successive day's work, or joints that have become cold because of delay, shall be tacked and shall be made carefully to insure continuous bond between old and new sections of the course. All joints shall have the same texture, density, and smoothness as other sections of the course. The tack shall be overlapped onto the previous pavement 25 mm (1 inch) or 50 mm (2 inches). Contact

surfaces of previously constructed pavements, curbs, gutters, manholes, etc., shall be tacked. If these surfaces have become coated with dust, sand, or other objectionable material shall be cleaned by brushing or cut back with an approved power saw, as directed. The surface against which new material is to be placed shall be sprayed with a thin, uniform coat of bituminous material conforming to the requirements of SECTION: BITUMINOUS TACK COAT. The material shall be applied far enough in advance of placement of the fresh mixture to insure adequate curing. Care shall be taken to prevent damage or contamination of the sprayed surface.

### 3.8.2 Transverse Joints

The roller shall pass over the unprotected end of freshly placed mixture only when placing of the course is discontinued or when delivery of mixture is interrupted to the extent that unrolled material may become cold. In all cases, the edge of the previously placed course shall be cut back to expose an even, vertical surface the full thickness of the course. In continuing placement of strip, the mechanical spreader shall be positioned on the transverse joint so that sufficient hot mixture will be spread to obtain a joint after rolling which conforms to the required density and smoothness specified herein. When required, the fresh mixture shall be raked against the joints, thoroughly tamped with hot tampers, smoothed with hot irons and rolled.

### 3.8.3 Longitudinal Joints

Longitudinal joints in surface course or intermediate course shall be offset as stated in specification paragraph: Offsetting Joints in Intermediate and Surface Courses. Procedures outlined in specification paragraph: Special Requirements for Placing Strips Succeeding Initial Strips shall be followed when making longitudinal joints. Edges of previously placed strips that have cooled or are irregular, honeycombed, poorly compacted, damaged, or otherwise defective, and unsatisfactory sections of the joint shall be cut back to expose a clean, sound surface for the full thickness of the course as directed. When required, fresh mixtures shall be raked against the joint, thoroughly tamped with hot tampers, smoothed with hot irons and rolled.

### 3.9 EDGES OF PAVEMENT

Edges of pavement adjacent to the shoulders shall be trimmed neatly to line. Shoulder material not less than 0.3 meters (1 foot) wide shall be placed against and to the full height of the pavement surface as soon as practicable after final rolling has been completed and the pavement has sufficiently hardened.

### 3.10 PROTECTION OF PAVEMENT

After final rolling of the pavement, no vehicular traffic of any kind shall be permitted until the pavement has cooled and hardened or for at least 6 hours.

### 3.11 SURFACE REQUIREMENTS

Finished surface of bituminous courses, when tested as specified below shall conform to gradeline and elevations shown and to surface-smoothness requirements specified.

#### 3.11.1 Plan Grade

The grade of the completed surface shall not deviate more than 1.5 mm (0.05 foot) from the plan grade.

#### 3.11.2 Bituminous Intermediate Course

Upon completion of final rolling the surface of the intermediate course, if any, shall be smooth and true to grade and cross section. When a 12-foot straightedge is laid on the surface parallel with the centerline of the paved area or transverse from crown to pavement edge, the surface shall not vary more than 1/4 inch from the straightedge. Surface irregularities exceeding these requirements shall be corrected as directed. Testing for plan-grade conformance and surface smoothness shall be performed by the Contracting Officer immediately after rolling is completed. Tests shall be made at intervals as directed.

#### 3.11.3 Bituminous Surface Course

The surface course, upon completion of final rolling, shall be smooth and true to grade and cross section. When a 3.66 meters (12-foot) straightedge is laid on the surface parallel with the centerline, the surface shall not vary more than 3.2 mm (1/8 inch) from the straightedge. When the 3.66 meters (12-foot) straightedge is laid on the surface transverse to the centerline between the crown and edge of payment, the surface shall not vary more than 6.4 mm (1/4 inch) from the straightedge. Low or defective areas shall be immediately corrected by cutting out the faulty areas with fresh, hot mixture, and compacting the area to conform to the remainder of the pavement. Testing for plan-grade conformance and surface smoothness shall be performed by the Contractor in the presence of a representative of the Contracting Officer immediately after rolling is completed. Tests shall be made at intervals as directed.

#### 3.11.4 Equipment

The Contractor shall furnish and maintain at the site, in good condition, one straightedge for each bituminous paver, for use of the Contracting Officer in testing the finished surface. Straightedges shall be aluminum or other approved lightweight metal and shall have blades of box or box-girder cross section with flat bottom, adequately reinforced to insure rigidity and accuracy. Straightedges shall have handles to facilitate movement on the pavement. Where devices other than straightedges are approved for surface smoothness determination, the Contractor shall furnish and maintain in good condition at the site, one such device for each bituminous paver.

#### 3.12 SAMPLING PAVEMENTS

Samples of finished pavement, including samples that span the longitudinal joints, shall be obtained by the Contractor. A minimum of one test (three cores or sawed samples) shall be taken for each tonnage lot represented by a Marshall test. The three cores or sawed samples shall be taken at locations throughout the tonnage lot. The locations shall not be previously marked. Sample shall be taken at locations determined by the Contracting Officer. Additional samples shall be taken and tested at the start of the paving operations when directed. One-half of the samples shall be cut from longitudinal joints. The Contracting Officer may require additional testing at no additional cost to the Government. The Government may also perform verification tests as considered necessary. Cores shall be at least 101.6 mm (4 inches) in diameter and sawed samples at least

127.0 mm (5 inches) on each side. The samples shall be tested by the Contractor to determine conformance to density, thickness and, if directed, other specified requirements. All quality control sampling and testing shall be the responsibility of the Contractor in accordance with paragraph SECTION: CONTRACTOR QUALITY CONTROL, specification paragraph: QUALITY CONTROL and as specified herein. Samples of each day's production shall be taken by noon of the following day and results of tests reported to the Contracting Officer by the end of that day. The Contractor shall furnish a power saw or core drill and labor for cutting samples and shall immediately replace the pavement. Sample holes shall have all surfaces tacked. Hot-mix bituminous mix shall be compacted in the sample hole to the satisfaction of the Contracting Officer. The finished surface of the repaired sample hole shall be sealed by mopping with tack coat.

### 3.13 INSPECTION OF PLANT AND EQUIPMENT

The Contracting Officer shall have access at all times to all parts of the paving plant for checking adequacy of equipment in use, for inspecting operation of plant, verifying weights, proportions, and character of materials, and for checking temperatures maintained in preparation of mixtures. Checks so made shall not relieve the Contractor from performing all work as specified.

-- End of Section --

## SECTION 02714

RAPID DRAINAGE LAYER  
12/97

## 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 basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 88	(1990) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(1987; R 1992) Sampling Aggregates
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock In Place by Nuclear Methods (Shallow Depth)
ASTM D 4791	(1995) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregates
ASTM E 548	(1994) General Criteria Used for Evaluating Laboratory Competence

## 1.2 SYSTEM DESCRIPTION

The Contractor shall build a drainage layer (also referred to as Rapid Drainage Material (RDM)) under the streets pavements as indicated and in

accordance with the following subparagraphs:

#### 1.2.1 Aggregate Drainage Layer

A drainage layer consisting of rapid draining materials (RDM) meeting the gradations of Table I.

#### 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Sampling and Testing; FIO-RE.

Copies of field test results within 24 hours of completion of tests.

Approval of Materials; GA, EC-GD.

Material sources and material test results prior to field use.

Evaluation; GA-RE.

Test section construction report.

#### 1.4 FIELD COMPACTION

Field compaction requirements shall be based on the results of a test section constructed by the Contractor, using the materials, methods, and equipment proposed for use in the work. The test section shall meet the requirements of paragraph TEST SECTION.

#### 1.5 EQUIPMENT

##### 1.5.1 General Requirements

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times.

##### 1.5.2 Placement Equipment

An asphalt paving machine shall be used to place drainage layer material. Alternate methods may be used if it can be demonstrated in the test section that these methods obtain the specified results.

##### 1.5.3 Compaction Equipment

A dual or single smooth drum roller which provides a maximum compactive effort without crushing the drainage layer aggregate shall be used to compact drainage layer material.

#### 1.6 WEATHER LIMITATION

Drainage layer material shall be placed when the atmospheric temperature is above 2 degrees C. Areas of completed drainage layer or underlying

courses that are damaged by freezing, rainfall, or other weather conditions or by contamination from sediments, dust, dirt, or foreign material shall be corrected by the Contractor to meet specified requirements.

## 1.7 SAMPLING AND TESTING

### 1.7.1 General Requirements

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory, or by the Contractor subject to approval. If the Contractor elects to establish testing facilities of his own, approval of such facilities shall be based on compliance with ASTM E 548, and no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved. The first inspection of the facilities will be at the expense of the Government and any subsequent inspections required because of failure of the first inspection shall be at the expense of the Contractor. Such costs will be deducted from the total amount due the Contractor. Drainage layer materials shall be tested to establish compliance with the specified requirements.

### 1.7.2 Sampling

Aggregate samples shall be taken in accordance with ASTM D 75.

### 1.7.3 Test Methods

#### 1.7.3.1 Sieve Analyses

Sieve analyses shall be made in accordance with ASTM C 117 and ASTM C 136.

#### 1.7.3.2 Density Tests

Field density tests shall be made in accordance with ASTM D 2922. When using this method, ASTM D 3017 shall be used to determine the moisture content of the aggregate drainage layer material. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph "Calibration" of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals as directed by the Contracting Officer.

#### 1.7.3.3 Soundness Test

Soundness tests shall be made in accordance with ASTM C 88.

#### 1.7.3.4 Los Angeles Abrasion Test

Los Angeles abrasion tests shall be made in accordance with ASTM C 131.

#### 1.7.3.5 Flat or Elongated Particles Tests

Flat and/or elongated particles tests shall be made in accordance with ASTM D 4791.

#### 1.7.3.6 Fractured Faces Tests

When aggregates are supplied from crushed gravel, approved test methods

shall be used to assure the aggregate meets the requirements for fractured faces in paragraph AGGREGATES.

#### 1.7.4 Testing Frequency

##### 1.7.4.1 Aggregate Drainage Layer

Sieve analyses, field density, and moisture content tests shall be performed at a rate of at least one test for every 1000 square meters of completed area and not less than one test for each day's production. Soundness tests and Los Angeles abrasion tests shall be performed at the rate of one test for every 10 sieve analysis tests.

#### 1.7.5 Approval of Materials

##### 1.7.5.1 Aggregate

The aggregate source shall be selected at least 60 days prior to field use in the test section. Tentative approval of the source will be based on certified test results to verify that materials proposed for use meet the contract requirements. Final approval of both the source and the material will be based on test section performance and tests for gradation, soundness, Los Angeles abrasion, flat and/or elongated particles tests and fractured faces tests. For aggregate drainage layer materials, these tests shall be performed on samples taken from the completed and compacted drainage layer course within the test section.

## PART 2 PRODUCTS

### 2.1 AGGREGATES

Aggregates shall consist of clean, sound, hard, durable, angular particles of crushed stone, which meet the specification requirements. The aggregates shall be free of silt and clay as defined by ASTM D 2487, vegetable matter, and other objectionable materials or coatings.

#### 2.1.1 Aggregate Quality

The aggregate shall have a soundness loss not greater than 18 percent weighted averaged at five cycles when tested in magnesium sulfate in accordance with ASTM C 88. The aggregate shall have a percentage of loss on abrasion not to exceed 40 after 500 revolutions as determined by ASTM C 131. The percentage of flat and/or elongated particles shall be determined by ASTM D 4791 with the following modifications. The aggregates shall be separated into 2 size fractions. Particles greater than 12.5 mm sieve and particles passing the 12.5 mm sieve and retained on the 4.75 mm sieve. The percentage of flat and/or elongated particles in either fraction shall not exceed 20. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. When the aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements. When the aggregate is supplied from crushed gravel it shall be manufactured from gravel particles, 90 percent of which by weight are retained on the maximum-size sieve listed in TABLE I. In the portion retained on each sieve specified, the crushed gravel shall contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the face. When two fractures are contiguous, the

angle between planes of the fractures must be at least 30 degrees in order to count as 2 fractured faces.

### 2.1.2 Gradation Requirements

Drainage layer aggregates shall be well graded within the limits specified in TABLE I.

TABLE I. GRADATION OF DRAINAGE LAYER MATERIAL  
Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	Rapid Draining Material (RDM)
37.50 mm	100
25.00 mm	70-100
19.00 mm	55-80
12.50 mm	40-60
9.50 mm	25-50
4.75 mm	8-30
2.36 mm	0-20
1.18 mm	0-5

NOTE 1: The values are based on aggregates of uniform specific gravity, and the percentages passing the various sieves may require appropriate correction by the Contracting Officer when aggregates of varying specific gravities are used.

## PART 3 EXECUTION

### 3.1 TEST SECTION

#### 3.1.1 Data

A test section shall be constructed to evaluate the ability to carry traffic and the constructability of the drainage layer including required mixing, placement, and compaction procedures. Test section data will be used by the Contracting Officer to determine the required number of passes and the field dry density requirements for full scale production.

#### 3.1.2 Scheduling

The test section shall be constructed a minimum of 30 days prior to the start of full scale production to provide sufficient time for an evaluation of the proposed materials, equipment and procedures including Government QA testing.

#### 3.1.3 Location and Size

The test section shall be placed within the limits of the RDM construction area at a location approved by the Contracting Officer. The underlying courses and subgrade preparation, required for the pavement section, shall be completed, inspected and approved in the test section prior to constructing the drainage layer. The test section shall be a minimum of 30 m long and one full paving lane wide.

#### 3.1.4 Initial Testing

Certified test results, to verify that the materials proposed for use in the test section meet the contract requirements, shall be provided by the Contractor and approved by the Contracting Officer prior to the start of the test section.

#### 3.1.5 Mixing, Placement, and Compaction

Mixing, placement, and compaction shall be accomplished using equipment meeting the requirements of paragraph EQUIPMENT. Compaction equipment speed shall be no greater than 2.4 km/hour.

#### 3.1.6 Procedure

##### 3.1.6.1 Aggregate Drainage Layer Tests

The test section shall be constructed with aggregate in a moist state so as to establish a correlation between number of roller passes and dry density achievable during field production. Density and moisture content tests shall be conducted at the surface and at intervals of 50 mm of depth down for the total layer thickness, in accordance with ASTM D 2922 and ASTM D 3017. Sieve analysis tests shall be conducted on composite samples, taken adjacent to the density test locations, which represent the total layer thickness. One set of tests (i.e. density, moisture, and sieve analysis) shall be taken before compaction and after each subsequent compaction pass at three separate locations as directed by the Contracting Officer. Compaction passes and density readings shall continue until the difference between the average dry densities of any two consecutive passes is less than or equal to 8 kg per cubic meter (0.5 pcf).

#### 3.1.7 Evaluation

Within 10 days of completion of the test section, the Contractor shall submit to the Contracting Officer a Test Section Construction Report complete with all required test data and correlations. The Contracting Officer will evaluate the data and provide to the Contractor the required number of passes of the roller, the dry density for field density control during construction, the depth at which to check the density, and the need for a final static pass of the roller.

### 3.2 PREPARATION OF UNDERLYING COURSE

Prior to constructing the drainage layer, the underlying course shall be cleaned of all foreign materials. During construction, the underlying course shall contain no frozen material. The underlying course shall conform to Section 02721 SUBBASE COURSES. Ruts or soft yielding spots in the underlying courses having inadequate compaction and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line, and grade, and recompacting to specified density. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the drainage layer is placed.

### 3.3 TRANSPORTING MATERIAL

#### 3.3.1 Aggregate Drainage Layer Material

Aggregate drainage layer material shall be transported to the site in a manner which prevents segregation and contamination of materials.

### 3.4 PLACING

#### 3.4.1 General Requisites

Drainage layer material shall be placed on the underlying course in lifts of uniform thickness using equipment meeting the requirements of paragraph EQUIPMENT. When a compacted layer 150 mm or less in thickness is required, the material shall be placed in a single lift. When a compacted layer in excess of 150 mm is required, the material shall be placed in lifts of equal thickness. No lift shall exceed 150 mm or be less than 75 mm when compacted. The lifts when compacted after placement shall be true to the grades or levels required with the least possible surface disturbance. Where the drainage layer is placed in more than one lift, the previously constructed lift shall be cleaned of loose and foreign material.

Such adjustments in placing procedures or equipment shall be made to obtain true grades and minimize segregation and degradation of the drainage layer material.

#### 3.4.2 Hand Spreading

In areas where machine spreading is impractical, drainage layer material shall be spread by hand. The material shall be spread uniformly in a loose layer to prevent segregation. The material shall conform to the required grade and thickness after compaction.

### 3.5 COMPACTION REQUIREMENTS

Compaction shall be accomplished using rollers meeting the requirements of paragraph EQUIPMENT and operating at a rolling speed of no greater than 2.4 km per hour. Each lift of drainage material, including shoulders when specified under the shoulders, shall be compacted with the number of passes of the roller as specified by the Contracting Officer. In addition, a minimum field dry density, as specified by the Contracting Officer, shall be maintained. If the required field dry density is not obtained, the number of roller passes shall be adjusted in accordance with paragraph DEFICIENCIES. Excessive rolling resulting in crushing of aggregate particles shall be avoided. In all places not accessible to the rollers, the drainage layer material shall be compacted with mechanical hand operated tampers.

### 3.6 FINISHING

The top surface of the drainage layer shall be finished after final compaction as determined from the test section. Adjustments in rolling and finishing procedures shall be made to obtain grades and minimize segregation and degradation of the drainage layer material.

### 3.7 EDGES OF DRAINAGE LAYER

Shoulder material shall be placed along the edges of the drainage layer course in a quantity that will compact to the thickness of the layer being constructed. When the drainage layer is being constructed in 2 or more lifts, at least a 300 mm width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each lift of the drainage layer.

### 3.8 SMOOTHNESS TEST

The surface of the top lift shall not deviate more than 10 mm when tested with a 3.05 m 10 foot straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding 10 mm shall be corrected in accordance with paragraph DEFICIENCIES.

### 3.9 THICKNESS CONTROL

The completed thickness of the drainage layer shall be within 13 mm of the thickness indicated. Thickness shall be measured at intervals providing at least one measurement for each 250 square meters of drainage layer. Measurements shall be made in test holes at least 75 mm in diameter. Where the measured thickness is more than 13 mm deficient, such areas shall be corrected in accordance with paragraph DEFICIENCIES. Where the measured thickness is 13 mm more than indicated, it will be considered as conforming to the requirements plus 13 mm, provided the surface of the drainage layer is within 13 mm of established grade. The average job thickness shall be the average of all job measurements as specified above but within 8 mm of the thickness shown on the drawings.

### 3.10 DEFICIENCIES

#### 3.10.1 Grade and Thickness

Deficiencies in grade and thickness shall be corrected so that both grade and thickness tolerances are met. Thin layers of material shall not be added to the top surface of the drainage layer to meet grade or increase thickness. If the elevation of the top of the drainage layer is more than 13 mm above the plan grade it shall be trimmed to grade and finished in accordance with paragraph FINISHING. If the elevation of the top surface of the drainage layer is 13 mm or more below the required grade, the surface of the drainage layer shall be scarified to a depth of at least 75 mm, new material shall be added, and the layer shall be blended and recompacted to bring it to grade. Where the measured thickness of the drainage layer is more than 13 mm deficient, such areas shall be corrected by excavating to the required depth and replaced with new material to obtain a compacted lift thickness of at least 75 mm. The depth of required excavation shall be controlled to keep the final surface elevation within grade requirements and to preserve layer thicknesses of materials below the drainage layer.

#### 3.10.2 Density

Density shall be considered deficient if the field dry density test results are below the dry density specified by the Contracting Officer. If the densities are deficient, the layer shall be rolled with 2 additional passes of the specified roller. If the dry density is still deficient, work will be stopped until the cause of the low dry densities can be determined by the Contracting Officer.

#### 3.10.3 Smoothness

Deficiencies in smoothness shall be corrected as if they are deficiencies in grade or thickness. All tolerances for grade and thickness shall be maintained while correcting smoothness deficiencies.

-- End of Section --

## SECTION 02721

## SUBBASE COURSES

03/97

## 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 basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO T 180 (1993) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457-mm (18-in) Drop

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 88 (1990) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

ASTM C 131 (1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM D 75 (1987; R 1992) Sampling Aggregates

ASTM D 1556 (1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 2922 (1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D 3017 (1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

ASTM D 4318 (1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM E 11 (1995) Wire-Cloth Sieves for Testing Purposes

## 1.2 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in AASHTO T 180, Method D. In this specification, degree of compaction shall be a percentage of laboratory maximum density.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation;

submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment; FIO-RE.

List of proposed equipment to be used in performance of construction work, including descriptive data.

SD-08 Statement

Material Source; GA-RE.

Source of the material to be used for producing aggregates in accordance with subparagraph: Approval of Materials. This shall be submitted with the report below

SD-09 Reports

Sampling and Testing; GA-KC.  
Copies of initial and in-place test results.

1.4 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved testing laboratory in accordance with Section 01440 CONTRACTOR QUALITY CONTROL. Tests shall be performed at the specified frequency. No work requiring testing will be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements.

1.4.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.4.2 Tests

1.4.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11.

1.4.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

1.4.2.3 Moisture-Density Determinations

The maximum density and optimum moisture shall be determined in accordance with AASHTO T 180, Method D.

1.4.2.4 Density Tests

Density shall be field measured in accordance with ASTM D 1556, ASTM D 2167 or ASTM D 2922. For the method presented in ASTM D 1556 the base plate as shown on the drawings shall be used. For the method presented in ASTM D 2922 the calibration curves shall be checked and adjusted, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and, when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration, in ASTM D 2922, on each different type of material to be tested at the beginning of a job and at intervals as directed.

#### 1.4.2.5 Soundness Test

Soundness tests shall be made in conformance with ASTM C 88.

#### 1.4.2.5 Wear Test

Wear tests shall be made on subbase course material in conformance with ASTM C 131.

#### 1.4.3 Testing Frequency

##### 1.4.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements prior to installation.

- a. Sieve Analysis not including 0.02 mm size material
- b. Liquid limit and plasticity index moisture-density relationship
- c. Wear Test
- d. Soundness Test

##### 1.4.3.2 In-Place Tests

One of each of the following tests shall be performed on samples taken from the placed and compacted subbase course. Samples shall be taken for each 835 square meters of each layer of material placed in each area and not less than on test for each day's placement.

- a. Sieve Analysis not including 0.02 mm size material
- b. Field Density
- c. Moisture liquid limit and plasticity index

#### 1.4.4 Approval of Material

The source of the material shall be selected at least 60 days prior to the time the material will be required in the work. Initial approval of the source will be based on an inspection by the Contracting Officer. Initial approval of material will be based on tests of samples for the specific job. Final approval of both the source and the material will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted subbase course.

#### 1.5 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 2 degrees C. When the temperature falls below 2 degrees C, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.6 EQUIPMENT

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Subbase Course

Aggregates shall consist of crushed stone or gravel, screenings, natural sand, or other clean, sound, durable, approved materials processed and blended or naturally combined. Aggregates shall be durable and sound, free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material. Material retained on the 4.75 mm sieve shall have a percentage of wear not to exceed 40 percent after 500 revolutions when tested as specified in ASTM C 131, and have a loss not greater than 24 percent weighted average at 5 cycles when tested for soundness in magnesium sulfate in accordance with ASTM C 88. The percentage of flat and/or elongated particles shall not exceed 20 in the fraction retained on the 12.5-mm (1/2 inch) sieve and in the fraction passing the 12.5-mm (1/2 inch) sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. When the course aggregate is supplied from more than one source, aggregate from each source shall meet the requirements set forth herein. In the portion retained on each sieve specified, the crushed gravel shall contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the face. Gradation requirements specified herein shall apply to the completed compacted material. When 2 fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as 2 fractured faces. Aggregates shall have a maximum size of 2mm and be graded continuously well within the limits specified as follows:

Percentage by Weight  
Passing Square-Mesh Sieve

Sieve Designation	No. 1
50 mm	100
37.5 mm	70-100

Liquid Limit and plasticity index requirements stated herein shall apply to any aggregate component that is blended to meet the required gradation and also to the aggregate in the completed aggregate surface. The portion of any blended component and of the completed course passing the 0.425 mm

shall be either nonplastic or shall have a liquid limit not greater than 25 and a plasticity index not greater than 5.

### PART 3 EXECUTION

#### 3.1 OPERATION OF AGGREGATE SOURCES

All clearing, stripping and excavating work involved in the opening or operation of aggregate sources shall be performed by the Contractor. Aggregate sources shall be opened to working depth in a manner that produces excavation faces that are as nearly vertical as practicable for the materials being excavated. Materials excavated from aggregate sources shall be obtained in successive cuts extending through all exposed strata. All pockets or strata of unsuitable materials overlying or occurring in the deposit shall be wasted as directed. The methods of operating aggregate sources and the processing and blending of the material may be changed or modified by the Contracting Officer, when necessary, in order to obtain material conforming to specified requirements. Upon completion of work, aggregate sources on Government reservations shall be conditioned to drain readily, and shall be left in a satisfactory condition. Aggregate sources on private lands shall be conditioned in agreement with local laws and authorities.

#### 3.2 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

#### 3.3 PREPARATION OF UNDERLYING MATERIAL

Prior to constructing the subbase course, the underlying course or subgrade shall be cleaned of all foreign substances. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. Ruts, or soft yielding spots, in the underlying courses, subgrade areas having inadequate compaction, and deviations of the surface from the specified requirements, shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the subbase course is placed.

#### 3.4 GRADE CONTROL

The finished and completed subbase course shall conform to the lines, grades, and cross sections shown. The lines, grades, and cross sections shown shall be maintained by means of line and grade stakes placed by the Contractor at the work site.

#### 3.5 MIXING AND PLACING MATERIALS

The materials shall be mixed and placed to obtain uniformity of the subbase material at the water content specified. The Contractor shall make such

adjustments in mixing or placing procedures or in equipment as may be directed to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to insure a satisfactory subbase course.

### 3.6 LAYER THICKNESS

The compacted thickness of the completed course shall be as indicated. When a compacted layer of 150 mm is specified, the material may be placed in a single layer; when a compacted thickness of more than 150 mm is required, no layer shall exceed 150 mm nor be less than 75 mm when compacted.

### 3.7 COMPACTION

Each layer of the subbase course shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus 2 percent of optimum water content, as determined from laboratory tests, as specified in paragraph SAMPLING AND TESTING. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer is compacted through the full depth to at least 95 percent of laboratory maximum density. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory subbase course. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

### 3.8 EDGES

Approved material shall be placed along the edges of the subbase course in such quantity as will compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least a 300 mm width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the subbase course, as directed.

### 3.9 SMOOTHNESS TEST

The surface of each layer shall not show deviations in excess of 10 mm when tested with a 3.6 m (12 foot) straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding this amount shall be corrected by removing material, replacing with new material, or reworking existing material and compacting, as directed.

### 3.10 THICKNESS CONTROL

The completed thickness of the subbase course shall be in accordance with the thickness and grade indicated on the drawings. The thickness of each course shall be measured at intervals providing at least one measurement for each 400 square meters or part thereof of subbase course. The thickness measurement shall be made by test holes, at least 75 mm in diameter through the course. The completed subbase course shall not be more than 13 mm deficient in thickness nor more than 13 mm above or below the established grade. Where any of these tolerances are exceeded, the Contractor shall correct such areas by scarifying, adding new material of

proper gradation or removing material, and compacting, as directed. Where the measured thickness is 13 mm or more thicker than shown, the course will be considered as conforming with the specified thickness requirements plus 13 mm. The average job thickness shall be the average of the job measurements as specified above but within 6 mm of the thickness shown.

3.11 MAINTENANCE

The subbase course shall be maintained in a satisfactory condition until accepted.

-- End of Section --

## SECTION 02721A

SUBBASE COURSES  
03/97

## 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 basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO T 180 (1997) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457-mm (18-in) Drop

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29/C 29M (1997) Bulk Density ("Unit Weight") and Voids in Aggregates

ASTM C 117 (1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C 131 (1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM C 136 (1996) Sieve Analysis of Fine and Coarse Aggregates

ASTM D 75 (1987; R 1997) Sampling Aggregates

ASTM D 422 (1963; R 1998) Particle-Size Analysis of Soils

ASTM D 1556 (1990; R 1996e1) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557 (1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))

ASTM D 2167 (1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method

ASTM D 2487 (1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 11	(1995) Wire-Cloth Sieves for Testing Purposes

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment; [\_\_\_\_], [\_\_\_\_]

List of proposed equipment to be used in performance of construction work, including descriptive data.

Waybills and Delivery Tickets; [\_\_\_\_], [\_\_\_\_]

Copies of waybills and delivery tickets during the progress of the work. Certified waybills and delivery tickets for all aggregates actually used.

SD-06 Test Reports

Sampling and Testing; [\_\_\_\_], [\_\_\_\_]

Copies of initial and in-place test results.

1.3 UNIT PRICES

1.3.1 Measurement

1.3.1.1 Area

The quantity of [subbase] [and] [select-material subbase] course completed and accepted as determined by the Contracting Officer shall be measured in square meters.

1.3.1.2 Volume

The quantity of [subbase] [and] [select-material subbase] course completed and accepted as determined by the Contracting Officer will be measured in cubic meters. The volume of material in-place and accepted will be determined by the average job thickness obtained in accordance with paragraph THICKNESS CONTROL and the dimensions shown.

### 1.3.1.3 Weight

The tonnage of [subbase] [and] [select-material subbase] course material shall be the number of metric tons of aggregate, [placed and accepted in the completed course] [placed in authorized stockpiles] as determined by the Contracting Officer. Deductions will be made for any material wasted, unused, rejected, or used for convenience of the Contractor, and for water exceeding specified amount at time of weighing.

### 1.3.2 Payment

#### 1.3.2.1 Course Material

Quantities of [subbase] [and] [select-material subbase] course, determined as specified in paragraph Measurement, will be paid for at the respective contract unit prices, which shall constitute full compensation for the construction and completion of the [subbase] [and] [select-material subbase] course.

#### 1.3.2.2 Stabilization

Cohesionless subgrades or select subbase courses to be stabilized, as specified in paragraph PREPARATION OF UNDERLYING MATERIAL, will be paid as a special item on the tonnage basis including extra manipulation as required.

### 1.3.3 Waybills and Delivery Tickets

Copies of waybills and delivery tickets shall be submitted during the progress of the work. Before the final statement is allowed, the Contractor shall file certified waybills and certified delivery tickets for all aggregates actually used.

## 1.4 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in [ASTM D 1557] [AASHTO T 180, Method D]. In this specification, degree of compaction shall be a percentage of laboratory maximum density.

## 1.5 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved testing laboratory in accordance with Section 01451 CONTRACTOR QUALITY CONTROL. Tests shall be performed at the specified frequency. No work requiring testing will be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements.

### 1.5.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

### 1.5.2 Tests

#### 1.5.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with [ASTM C 117 and ASTM C 136] [and] [ASTM D 422]. Sieves shall conform to ASTM E 11.

#### 1.5.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

#### 1.5.2.3 Moisture-Density Determinations

The maximum density and optimum moisture shall be determined in accordance with [ASTM D 1557] [AASHTO T 180, Method D].

#### 1.5.2.4 Density Tests

Density shall be field measured in accordance with [ASTM D 1556. The base plate, as shown in the drawing shall be used.] [ASTM D 2167.] [ASTM D 2922.

The calibration curves shall be checked and adjusted, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and, when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration, in ASTM D 2922, on each different type of material to be tested at the beginning of a job and at intervals as directed.]

#### 1.5.2.5 Wear Test

Wear tests shall be made on subbase course material in conformance with ASTM C 131.

#### 1.5.2.6 Weight of Slag

Weight per cubic meter of slag shall be determined in accordance with ASTM C 29/C 29M on the subbase course material.

### 1.5.3 Testing Frequency

#### 1.5.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements prior to installation.

- a. Sieve Analysis [including] [not including] 0.02 mm size material
- b. Liquid limit and plasticity index moisture-density relationship
- c. [Wear]
- d. [Weight per cubic meter of Slag]
- e. [\_\_\_\_\_].

#### 1.5.3.2 In-Place Tests

One of each of the following tests shall be performed on samples taken from the placed and compacted [subbase] [and] [select-material subbase] course. Samples shall be taken for each [\_\_\_\_\_] square meters of each layer of

material placed in each area.

- a. Sieve Analysis [including] [not including] 0.02 mm size material
- b. Field Density
- c. Moisture liquid limit and plasticity index

1.5.4 Approval of Material

The source of the material shall be selected [\_\_\_\_\_] days prior to the time the material will be required in the work. Approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted subbase course.

1.6 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 2 degrees C. When the temperature falls below 2 degrees C, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

1.7 EQUIPMENT

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Subbase Course

Aggregates shall consist of crushed stone or slag, gravel, shell, sand, or other sound, durable, approved materials processed and blended or naturally combined. Aggregates shall be durable and sound, free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material. Material retained on the 4.75 mm sieve shall have a percentage of wear not to exceed 50 percent after 500 revolutions when tested as specified in ASTM C 131. Aggregate shall be reasonably uniform in density and quality. Slag shall be an air-cooled, blast-furnace product having a dry weight of not less than 1050 kg/cubic meter. Aggregates shall have a maximum size of [\_\_\_\_\_] mm and shall be within the limits specified as follows:

Maximum Allowable Percentage by Weight  
Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3	No.4
2 mm	50	80	--	85
0.075 mm	15	15	15	15

[Particles having diameters less than 0.02 mm shall not be in excess of 3

percent by weight of the total sample tested as determined in accordance with ASTM D 422.] The portion of any blended component and of the completed course passing the 0.425 mm shall be either nonplastic or shall have a liquid limit not greater than 25 and a plasticity index not greater than 5.

#### 2.1.2 Select-Material Subbase Course

Materials shall consist of selected soil or other materials from field excavation, stockpiles, or other sources. Material shall be free from lumps and balls of clay and from organic and other objectionable matter. Not more than 25 percent by weight shall pass the 0.075 mm sieve. The portion of material passing the 0.425 mm sieve shall have a liquid limit less than 35 and a plasticity index less than 12. The maximum particle size shall not exceed 75 mm.[Particles having diameters less than 0.02 millimeter shall not be in excess of 3 percent by weight of the total sample tested as determined in accordance with ASTM D 422.]

### PART 3 EXECUTION

#### 3.1 OPERATION OF AGGREGATE SOURCES

All clearing, stripping and excavating work involved in the opening or operation of aggregate sources shall be performed by the Contractor. Aggregate sources shall be opened to working depth in a manner that produces excavation faces that are as nearly vertical as practicable for the materials being excavated. Materials excavated from aggregate sources shall be obtained in successive cuts extending through all exposed strata. All pockets or strata of unsuitable materials overlying or occurring in the deposit shall be wasted as directed. The methods of operating aggregate sources and the processing and blending of the material may be changed or modified by the Contracting Officer, when necessary, in order to obtain material conforming to specified requirements. Upon completion of work, aggregate sources on Government reservations shall be conditioned to drain readily, and shall be left in a satisfactory condition. Aggregate sources on private lands shall be conditioned in agreement with local laws and authorities.

#### 3.2 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

#### 3.3 PREPARATION OF UNDERLYING MATERIAL

Prior to constructing the [subbase] [or] [select-material subbase] course, the underlying course or subgrade shall be cleaned of all foreign substances. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. Ruts, or soft yielding spots, in the underlying courses, subgrade areas having inadequate compaction, and deviations of the surface from the specified requirements, shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. [For cohesionless underlying courses or

subgrades containing sands or gravels, as defined in ASTM D 2487, the surface shall be stabilized prior to placement of the subbase course. Stabilization shall be accomplished by mixing subbase-course material into the underlying course, and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements for the underlying course.] The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the subbase course is placed.

#### 3.4 GRADE CONTROL

The finished and completed subbase course shall conform to the lines, grades, and cross sections shown. The lines, grades, and cross sections shown shall be maintained by means of line and grade stakes placed by the Contractor at the work site.

#### 3.5 MIXING AND PLACING MATERIALS

The materials shall be mixed and placed to obtain uniformity of the [subbase] [and] [select-material subbase] material at the water content specified. The Contractor shall make such adjustments in mixing or placing procedures or in equipment as may be directed to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to insure a satisfactory subbase course.

#### 3.6 LAYER THICKNESS

The compacted thickness of the completed course shall be as indicated. When a compacted layer of 150 mm is specified, the material may be placed in a single layer; when a compacted thickness of more than 150 mm is required, no layer shall exceed 150 mm nor be less than 75 mm when compacted.

#### 3.7 COMPACTION

Each layer of the [subbase course] [and] [select-material subbase] shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus [\_\_\_\_\_] percent of optimum water content, as determined from laboratory tests, as specified in paragraph SAMPLING AND TESTING. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer is compacted through the full depth to at least [\_\_\_\_\_] percent of laboratory maximum density. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory subbase course. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

#### 3.8 PROOF ROLLING

Areas designated on the drawings to be proof rolled shall receive an application of 30 coverages with a heavy pneumatic-tired roller having four or more tires abreast, each tire loaded to a minimum of 13.6 metric tons and inflated to a minimum of 1.035 MPa. A coverage is defined as the application of one tire print over the designated area. In the areas

designated, proof rolling shall be applied to the top layer of the subbase course. Water content of the top layer of the subbase course shall be maintained such that the water content is within plus or minus [\_\_\_\_\_] percent of optimum water content, as determined from laboratory tests, as specified in paragraph SAMPLING AND TESTING. Any material in the subbase courses or underlying materials indicated to be unsatisfactory by the proof rolling shall be removed, dried, and recompact, or removed and replaced with satisfactory materials.

### 3.9 EDGES

Approved material shall be placed along the edges of the [subbase] [and] [select-material subbase] course in such quantity as will compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least a 300 mm width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the subbase course, as directed.

### 3.10 SMOOTHNESS TEST

The surface of each layer shall not show deviations in excess of 10 mm when tested with a 3.6 m (12 foot) straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding this amount shall be corrected by removing material, replacing with new material, or reworking existing material and compacting, as directed.

### 3.11 THICKNESS CONTROL

The completed thickness of the [subbase] [and] [select-material subbase] course shall be in accordance with the thickness and grade indicated on the drawings. The thickness of each course shall be measured at intervals providing at least one measurement for each 400 square meters or part thereof of subbase course. The thickness measurement shall be made by test holes, at least 75 mm in diameter through the course. The completed subbase course shall not be more than 13 mm deficient in thickness nor more than 13 mm above or below the established grade. Where any of these tolerances are exceeded, the Contractor shall correct such areas by scarifying, adding new material of proper gradation or removing material, and compacting, as directed. Where the measured thickness is 13 mm or more thicker than shown, the course will be considered as conforming with the specified thickness requirements plus 13 mm. The average job thickness shall be the average of the job measurements as specified above but within 6 mm of the thickness shown.

### 3.12 MAINTENANCE

The [subbase] [and] [select-material subbase] course shall be maintained in a satisfactory condition until accepted.

-- End of Section --

## SECTION 02722

GRADED, CRUSHED AGGREGATE BASE COURSE AND RIGID BASE COURSE  
12/97

## 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 basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO T 180 (1993) Moisture-Density Relations of Soils Using a 10-lb. (4.54 kg) Rammer and an 18-in (457 mm) Drop

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 88 (1990) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

ASTM C 117 (1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C 131 (1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM C 136 (1996a) Sieve Analysis of Fine and Coarse Aggregates

ASTM D 75 (1987; R 1992) Sampling Aggregates

ASTM D 1556 (1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 2487 (1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)

ASTM D 2922 (1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

ASTM D 3017 (1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

ASTM D 4318 (1995a) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM E 11 (1995) Wire-Cloth Sieves for Testing Purposes

ASTM E 548 (1994) General Criteria Used for Evaluating Laboratory Competence

1.2 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in AASHTO T 180, Method D. This will be abbreviated herein after as percentage of laboratory maximum density.

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment; FIO-RE

List of proposed equipment to be used in performance of construction work, including descriptive data.

SD-08 Statements

Material Source; GA-KC

Source of the material to be used for producing aggregates in accordance with subparagraph: Approval of Materials. This shall be submitted with the report below.

SD-09 Reports

Sampling and Testing; GA-KC

SAMPLING AND TESTING; GA-KC

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory, or by the Contractor, subject to approval.

Copies of initial and in-place test results.

1.4 EQUIPMENT

1.4.1 Approval

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as indicated.

1.4.2 Weather Limitation

Base courses shall be placed when the atmospheric temperature is above 2 degrees C. Areas of completed base course that are damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirement.

## 1.5 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory, or by the Contractor, subject to approval. If the Contractor elects to establish its own testing facilities, approval of such facilities shall be based on compliance with ASTM E 548, and work requiring testing will not be permitted until the Contractor's facilities have been inspected and approved. The first inspection of the facilities will be at the expense of the Government and any subsequent inspections, required because of failure of the first inspection, shall be at the expense of the Contractor. Such costs will be deducted from the total amount due the Contractor. The materials shall be tested to establish compliance with the specified requirements. Copies of test results shall be furnished to the Contracting Officer.

### 1.5.1 Sampling

Sampling for material gradation, liquid limit, and plastic limit tests shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

### 1.5.2 Tests

#### 1.5.2.1 Initial Tests

One of each of the following tests shall be performed on the proposed material, prior to commencing construction for each source of material: Sieve analysis, wear test, soundness, liquid limit and plasticity index, and moisture-density relationships. Test results shall be submitted to the Contracting Officer prior to commencing construction.

#### 1.5.2.1 Sieve Analyses

Sieve analyses shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11.

#### 1.5.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

#### 1.5.2.3 Testing Frequency

Testing frequency for sieve analysis, liquid limit and plasticity index: Results shall verify that the material complies with the specifications. After the initial test, a minimum of one analysis shall be performed for each 1,000 metric ton (1,000 tons) of material placed, with a minimum of one analysis for each day's placement until the base course is completed. When the source of materials is changed or deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced.

#### 1.5.2.5 Density Tests

Density shall be measured in the field in accordance with ASTM D 1556 or ASTM D 2922. For the method presented in ASTM D 1556 the base plate as shown in the drawing shall be used. For the method presented in ASTM D 2922 the calibration curves shall be checked and adjusted if necessary using only the sand cone method as described in paragraph Calibration of the ASTM publication. Tests performed in accordance with ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals as directed. Not less than one test shall be made to determine the field density of the compacted base course for each 1000 square meters (1000 square yards) of each layer of material placed and not less than one test for each day's placement.

#### 1.5.2.4 Soundness Test

Soundness tests shall be made in conformance with ASTM C 88.

#### 1.5.2.5 Wear Test

Wear tests shall be made in conformance with ASTM C 131.

#### 1.5.3 Approval of Material

The source of the material to be used for producing aggregates shall be selected 60 days prior to the time the material will be required in the work. Tentative approval of the source will be based on an inspection by the Contracting Officer. Tentative approval of material will be based on tests of samples for the specific job. Final approval of both the source and the material will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted base course.

### PART 2 PRODUCTS

#### 2.1 AGGREGATES

Aggregates shall consist of clean, sound, durable particles of crushed stone or crushed gravel, and screenings. The Contractor shall obtain materials that meet the specification and can be used to meet the grade and smoothness requirements specified herein, after compaction operations have been completed. The aggregates shall be free of silt and clay as defined by ASTM D 2487, vegetable matter, and other objectionable materials or coatings. The portion retained on the 4.75 mm sieve shall be known as coarse aggregate; that portion passing the 4.75 mm sieve shall be known as fine aggregate.

##### 2.1.1 Coarse Aggregates

Coarse aggregates shall be angular particles of uniform density. The coarse aggregate shall have a loss not greater than 24 percent weighted averaged at 5 cycles when tested for soundness in magnesium sulfate in accordance with ASTM C 88. The coarse aggregate shall have a percentage of

wear not to exceed 40 after 500 revolutions as determined by ASTM C 131. The percentage of flat and/or elongated particles shall not exceed 20 in the fraction retained on the 13 mm sieve and in the fraction passing the 13 mm sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements. Crushed gravel shall be manufactured from gravel particles 90 percent of which by weight are retained on the maximum-size sieve listed in TABLE I. In the portion retained on each sieve specified, the crushed gravel shall contain at least 90 percent by weight of crushed pieces having 2 or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the plane. When 2 fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as 2 fractured faces.

2.1.2 Fine Aggregate

Fine aggregate shall be natural sand or angular particles produced by crushing stone or gravel that meets the requirements for wear and soundness specified for coarse aggregate.

2.1.3 Gradation Requirements

Gradation requirements specified shall apply to the completed base course. The aggregates shall have a maximum size of 50 mm and be graded continuously within the limits specified in TABLE I. Sieves shall conform to ASTM E 11.

TABLE I. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1
50.0 mm	100
37.5 mm	70-100
25 mm	45-80
12.5 mm	30-60
4.75 mm	20-50
2 mm	15-40
0.425 mm	5-25
0.075 mm	0-10

NOTE 1: The values are based on aggregates of uniform specific gravity, and the percentages passing the various sieves may require appropriate correction by the Contracting Officer when aggregates of varying specific gravities are used.

2.1.4 Liquid Limit and Plasticity Index

Liquid limit and plasticity index requirements stated herein shall apply to any aggregate component that is blended to meet the required gradation and also to the aggregate in the completed base course. The portion of the aggregate passing the 0.425 mm sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

## PART 3 EXECUTION

### 3.1 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

### 3.2 PREPARATION OF UNDERLYING COURSE

Prior to constructing the crushed, aggregate base course, the underlying course shall be cleaned of all foreign substances. At the time of construction of the base course, the underlying course shall contain no frozen material. The underlying course shall conform to Section LIME-MODIFIED SUBGRADE or SUBBASE COURSES. Ruts or soft, yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements specified shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the base course is placed.

### 3.3 GRADE CONTROL

During construction, the lines and grades, including crown and cross slope indicated for the base course, shall be maintained by means of line and grade stakes placed by the Contractor.

### 3.4 MIXING OF MATERIALS

The coarse and fine aggregates shall be mixed in a stationary plant, or in a traveling plant or bucket loader on an approved paved working area. The Contractor shall make such adjustments in mixing procedures or in equipment as may be directed to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to ensure a satisfactory base course meeting requirements of this specification.

### 3.5 PLACING

The mixed material shall be placed on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. When a compacted layer 150 mm or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 150 mm is required, the material shall be placed in layers of equal thickness. No layer shall exceed 150 mm or be less than 75 mm when compacted. The layers, when compacted, shall be true to the grades or levels required, with the least possible surface disturbance. Where the base course is placed in more than 1 layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Adjustments in placing procedures or equipment shall be made as directed, to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to ensure an acceptable base course.

### 3.6 COMPACTION

#### 3.6.1 Requirements

Each layer of base course, including shoulders, shall be compacted to produce an average field-measured density, through the full depth, of at least 100 percent of laboratory maximum density obtained in the laboratory for graded crushed aggregate base course and 95 percent of laboratory maximum density for rigid base course. Water content shall be maintained during the compaction procedure and subsequent proof rolling of designated areas. Water content shall be within plus or minus 2 percent of optimum water content, as determined from laboratory tests and as specified in density test procedures listed in paragraph SAMPLING AND TESTING. In places not accessible to the rollers, the base course material shall be compacted with mechanical tampers.

#### 3.6.2 Finishing

The surface of top layer of base course shall be finished after final compaction by cutting any overbuild to grade and rolling with a steel-wheeled roller. Thin layers of material shall not be added to the top layer of base course to meet grade. If the elevation of top layer of base course is 13 mm or more below the grade, the top layer of base shall be scarified to a depth of at least 75 mm, new material shall be added, and the layer shall be blended and recompacted to bring to grade. Adjustments in rolling and finishing procedures shall be made as may be directed to obtain grades, to minimize segregation and degradation of base course material, to adjust the water content, and to ensure an acceptable base course. Material found unacceptable shall be removed and replaced, as directed, with acceptable material.

#### 3.7 EDGES OF BASE COURSE

Acceptable material shall be placed along the edges of the base course that will compact to the thickness of the course being constructed. When the course is being constructed in 2 or more layers, at least a 300 mm width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the base course, as directed.

#### 3.8 SMOOTHNESS TEST

The surface of the top layer shall not deviate more than 10 mm when tested with a 3.05 m straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding 10 mm shall be corrected as directed.

#### 3.9 THICKNESS CONTROL

The completed thickness of the base course shall be within 13 mm of the thickness indicated. The thickness of the base course shall be measured at intervals of one measurement for at least each 400 square meters of base course. The depth measurement shall be made by test holes at least 75 mm in diameter. Where the measured thickness of the base course is more than 13 mm deficient, such areas shall be corrected by excavating to the required depth and replacing with new material. Where the measured thickness of the base course is 13 mm more than indicated, it will be considered as conforming with the requirements plus 13 mm, provided the surface of the base course is within 13 mm of established grade. The average job thickness shall be the average of the job measurements as

specified above but within 6 mm of the thickness indicated.

3.10 MAINTENANCE

The base course shall be maintained in a condition that will meet specification requirements until accepted.

-- End of Section --

## SECTION 02722A

AGGREGATE AND/OR GRADED-CRUSHED AGGREGATE BASE COURSE  
05/01

## 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 basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO T 180	(1997) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457 mm (18-in) Drop
AASHTO T 224	(1996) Correction for Coarse Particles in the Soil Compaction Test

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29/C 29M	(1997) Bulk Density ("Unit Weight") and Voids in Aggregates
ASTM C 88	(1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 127	(1988; R 1993e1) Specific Gravity and Absorption of Course Aggregate
ASTM C 128	(1997) Specific Gravity and Absorption of Fine Aggregate
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM D 422	(1963; R 1998) Particle-Size Analysis of Soils
ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method

ASTM D 1557	(1991; R 1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(2000) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996e1) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996e1) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 11	(1995) Wire-Cloth Sieves for Testing Purposes

## 1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

### 1.2.1 Aggregate Base Course

Aggregate base course (ABC) is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

### 1.2.2 Graded-crushed Aggregate Base Course

Graded-crushed aggregate (GCA) base course is well graded, crushed, durable aggregate uniformly moistened and mechanically stabilized by compaction. GCA is similar to ABC, but it has more stringent requirements and it produces a base course with higher strength and stability.

### 1.2.3 Degree of Compaction

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in [ASTM D 1557] [AASHTO T 180, Method D and corrected with AASHTO T 224].

## 1.3 UNIT PRICES

### 1.3.1 Measurement

#### 1.3.1.1 Area

The quantity of [ABC] [and] [GCA] completed and accepted, as determined by the Contracting Officer, will be measured in square meters.

#### 1.3.1.2 Volume

The quantity of [ABC] [and] [GCA] completed and accepted, as determined by the Contracting Officer, will be measured in cubic meters. The volume of material in-place and accepted will be determined by the average job thickness obtained in accordance with paragraph THICKNESS CONTROL and the dimensions shown.

#### 1.3.1.3 Weight

The tonnage of [ABC] [and] [GCA] material will be the number of metric tons of aggregate, [placed and accepted in the completed course] [plus the amount] [placed in authorized stockpiles], as determined by the Contracting Officer. Deductions will be made for any material wasted, unused, rejected, or used for convenience of the Contractor, and for water exceeding specified amount at time of weighing.

#### 1.3.2 Payment for Quantities

Quantities of [ABC] [and] [GCA], determined as specified above, will be paid for at the respective contract unit prices, which shall constitute full compensation for the construction and completion of the [ABC] [and] [GCA].

#### 1.3.3 Payment for Stabilization of Underlying Course

Stabilization of cohesionless subgrade or subbase courses, as specified in paragraph PREPARATION OF UNDERLYING COURSE, will be paid for as a special item on a tonnage basis. This tonnage price shall include the price of extra manipulation as required.

### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-03 Product Data

Plant, Equipment, and Tools; [\_\_\_\_], [\_\_\_\_]

List of proposed equipment to be used in performance of construction work, including descriptive data.

Waybills and Delivery Tickets; [\_\_\_\_], [\_\_\_\_]

Copies of waybills and delivery tickets during the progress of the work. Before the final statement is allowed, the Contractor shall file certified waybills and certified delivery tickets for all aggregates actually used.

#### SD-06 Test Reports

Sampling and testing; [\_\_\_\_], [\_\_\_\_]

Field Density Tests; [\_\_\_\_], [\_\_\_\_]

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within [24] [\_\_\_\_] hours after the tests are performed.

Certified copies of test results for approval not less than [30]  
[\_\_\_\_\_] days before material is required for the work.

## 1.5 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by a testing laboratory approved in accordance with Section 01451 CONTRACTOR QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements; testing shall be performed at the specified frequency. The Contracting Officer may specify the time and location of the tests. Copies of test results shall be furnished to the Contracting Officer within 24 hours of completion of the tests.

### 1.5.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

### 1.5.2 Tests

The following tests shall be performed in conformance with the applicable standards listed.

#### 1.5.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11. [Particle-size analysis of the soils shall also be completed in conformance with ASTM D 422].

#### 1.5.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

#### 1.5.2.3 Moisture-Density Determinations

The maximum density and optimum moisture content shall be determined in accordance with [ASTM D 1557] [AASHTO T 180, Method D and corrected with AASHTO T 224. To maintain the same percentage of coarse material, the "remove and replace" procedure as described in the NOTE 8 in Paragraph 7.2 of AASHTO T 180 shall be used.].

#### 1.5.2.4 Field Density Tests

Density shall be field measured in accordance with [ASTM D 1556] [ASTM D 2167] [ASTM D 2922]. [For the method presented in ASTM D 1556 the base plate as shown in the drawing shall be used.] [For the method presented in ASTM D 2922 the calibration curves shall be checked and adjusted if necessary using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in

paragraph Calibration of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals as directed.]

#### 1.5.2.5 Wear Test

Wear tests shall be made on [ABC] [and] [GCA] course material in conformance with ASTM C 131.

#### 1.5.2.6 Soundness

Soundness tests shall be made on GCA in accordance with ASTM C 88.

#### 1.5.2.7 Weight of Slag

Weight per cubic meter of slag shall be determined in accordance with ASTM C 29/C 29M on the [ABC] [and] [GCA] course material.

### 1.5.3 Testing Frequency

#### 1.5.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements when furnished. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

- a. Sieve Analysis [including 0.02 mm size material].
- b. Liquid limit and plasticity index.
- c. Moisture-density relationship.
- d. Wear.
- e. [Soundness].
- f. [Weight per cubic meter of Slag].
- g. [\_\_\_\_\_].

#### 1.5.3.2 In Place Tests

Each of the following tests shall be performed on samples taken from the placed and compacted [ABC] [and] [GCA]. Samples shall be taken and tested at the rates indicated.

a. Density tests shall be performed on every lift of material placed and at a frequency of one set of tests for every [250 square meters] [\_\_\_\_\_], or portion thereof, of completed area.

b. Sieve Analysis [including 0.02 mm size material] shall be performed for every [500 metric tons] [\_\_\_\_\_], or portion thereof, of material placed.

c. Liquid limit and plasticity index tests shall be performed at the same frequency as the sieve analysis.

#### 1.5.4 Approval of Material

The source of the material shall be selected [\_\_\_\_\_] days prior to the time the material will be required in the work. Tentative approval of material will be based on initial test results. Final approval of the materials will be based on sieve analysis, liquid limit, and plasticity index tests performed on samples taken from the completed and fully compacted [ABC] [and] [GCA].

#### 1.6 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 2 degrees C. When the temperature falls below 2 degrees C, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

#### 1.7 PLANT, EQUIPMENT, AND TOOLS

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

### PART 2 PRODUCTS

#### 2.1 AGGREGATES

The [ABC] [and] [GCA] shall consist of clean, sound, durable particles of crushed stone, crushed slag, crushed gravel, crushed recycled concrete, angular sand, or other approved material. [ABC shall be free of lumps of clay, organic matter, and other objectionable materials or coatings.] [GCA shall be free of silt and clay as defined by ASTM D 2487, organic matter, and other objectionable materials or coatings.] The portion retained on the 4.75 mm sieve shall be known as coarse aggregate; that portion passing the 4.75 mm sieve shall be known as fine aggregate.

##### 2.1.1 Coarse Aggregate

Coarse aggregates shall be angular particles of uniform density. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements and shall be stockpiled separately.

a. Crushed Gravel: Crushed gravel shall be manufactured by crushing gravels, and shall meet all the requirements specified below.

b. Crushed Stone: Crushed stone shall consist of freshly mined quarry rock, and shall meet all the requirements specified below.

c. Crushed Recycled Concrete: Crushed recycled concrete shall consist of previously hardened portland cement concrete or other concrete containing pozzolanic binder material. The recycled material shall be free of all reinforcing steel, bituminous concrete surfacing, and any other foreign material and shall be crushed and processed to meet the required gradations for coarse aggregate. Crushed recycled concrete shall meet all other applicable requirements specified below.

d. Crushed Slag: Crushed slag shall be an air-cooled blast-furnace product having an air dry unit weight of not less than 1045 kg/cubic meter as determined by ASTM C 29/C 29M, and shall meet all the requirements specified below.

#### 2.1.1.1 Aggregate Base Course

ABC coarse aggregate shall not show more than 50 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregates shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 50 percent of which, by weight, are retained on the maximum size sieve listed in TABLE 1.

#### 2.1.1.2 Graded-Crushed Aggregate Base Course

GCA coarse aggregate shall not show more than [40] [50] percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. GCA coarse aggregate shall not exhibit a loss greater than [40] [50] percent weighted average, at five cycles, when tested for soundness in magnesium sulfate in accordance with ASTM C 88. The amount of flat and elongated particles shall not exceed 20 percent for the fraction retained on the 12.5 mm sieve nor 20 percent for the fraction passing the 12.5 mm sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregate shall contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 90 percent of which by weight are retained on the maximum size sieve listed in TABLE 1.

#### 2.1.2 Fine Aggregate

Fine aggregates shall be angular particles of uniform density. When the fine aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements.

##### 2.1.2.1 Aggregate Base Course

ABC fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

##### 2.1.2.2 Graded-Crushed Aggregate Base Course

GCA fine aggregate shall consist of angular particles produced by crushing stone, slag, recycled concrete, or gravel that meets the requirements for wear and soundness specified for GCA coarse aggregate. [Fine aggregate

shall be produced by crushing only particles larger than 4.75 mm sieve in size. The fine aggregate shall contain at least 90 percent by weight of particles having two or more freshly fractured faces in the portion passing the 4.75 mm sieve and retained on the 2 mm sieve, and in the portion passing the 2 mm sieve and retained on the 0.425 mm sieve.] [Fine aggregate shall be manufactured from gravel particles 95 percent of which by weight are retained on the 12.5 mm sieve.]

2.1.3 Gradation Requirements

The specified gradation requirements shall apply to the completed base course. The aggregates shall have a maximum size of [\_\_\_\_\_] mm and shall be continuously well graded within the limits specified in TABLE 1. Sieves shall conform to ASTM E 11.

TABLE 1. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3
50.0 mm	100	----	----
37.5 mm	70-100	100	----
25.0 mm	45-80	60-100	100
12.5 mm	30-60	30-65	40-70
4.75 mm	20-50	20-50	20-50
2.00 mm	15-40	15-40	15-40
0.425 mm	5-25	5-25	5-25
0.075 mm	0-8	0-8	0-8

NOTE 1: Particles having diameters less than 0.02 mm shall not be in excess of 3 percent by weight of the total sample tested.

NOTE 2: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, they shall be tested in accordance with ASTM C 127 and ASTM C 128 to determine their specific gravities. If the specific gravities vary by more than 10 percent, the percentages passing the various sieves shall be corrected as directed by the Contracting Officer.

2.1.4 Liquid Limit and Plasticity Index

Liquid limit and plasticity index requirements shall apply to the completed course and shall also apply to any component that is blended to meet the required gradation. The portion of any component or of the completed course passing the 0.425 mm sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the [ABC] [or] [GCA] is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms

may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

### 3.2 OPERATION OF AGGREGATE SOURCES

[Aggregate sources shall be cleared, stripped and excavated to working depths producing excavation faces that are as nearly vertical as practicable for the materials being excavated. Strata of unsuitable materials overlying or occurring in the deposit shall be wasted. Methods of operating aggregate sources, and the processing and blending of the materials, shall be changed or modified if necessary to obtain material conforming to the specified requirements. Upon completion of the work, aggregate sources shall be conditioned to drain readily and be left in a satisfactory condition.] [Aggregates shall be obtained from offsite sources.]

### 3.3 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

### 3.4 PREPARATION OF UNDERLYING COURSE

Prior to constructing the [ABC] [and] [GCA], the underlying course or subgrade shall be cleaned of all foreign substances. At the time of construction of the [ABC] [and] [GCA], the underlying course shall contain no frozen material. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. The underlying course shall conform to [Section 02300 EARTHWORK] [Section 02721 SUBBASE COURSES].

Ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses containing sands or gravels, as defined in ASTM D 2487, the surface shall be stabilized prior to placement of the [ABC] [and] [GCA]. Stabilization shall be accomplished by mixing [ABC] [or] [GCA] into the underlying course and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements of the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the [ABC] [and] [GCA] is placed.

### 3.5 INSTALLATION

#### 3.5.1 Mixing the Materials

The coarse and fine aggregates shall be mixed in a stationary plant, or in a traveling plant or bucket loader on an approved paved working area. The

Contractor shall make adjustments in mixing procedures or in equipment as directed to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory [ABC] [and] [GCA] meeting all requirements of this specification.

### 3.5.2 Placing

The mixed material shall be placed on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. When a compacted layer 150 mm or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 150 mm is required, the material shall be placed in layers of equal thickness. No layer shall exceed 150 mm or less than 75mm when compacted. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the [ABC] [and] [GCA] is placed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable [ABC] [and] [GCA].

### 3.5.3 Grade Control

The finished and completed [ABC] [and] [GCA] shall conform to the lines, grades, and cross sections shown. Underlying material(s) shall be excavated and prepared at sufficient depth for the required [ABC] [and] [GCA] thickness so that the finished [ABC] [and] [GCA] with the subsequent surface course will meet the designated grades.

### 3.5.4 Edges of Base Course

The [ABC] [and] [GCA] shall be placed so that the completed section will be a minimum of [1.5] [\_\_\_\_\_] m wider, on all sides, than the next layer that will be placed above it. Additionally, approved fill material shall be placed along the outer edges of [ABC] [and] [GCA] in sufficient quantities to compact to the thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least a 600 mm width of this material to be rolled and compacted simultaneously with rolling and compacting of each layer of [ABC] [and] [GCA]. If this base course material is to be placed adjacent to another pavement section, then the layers for both of these sections shall be placed and compacted along this edge at the same time.

### 3.5.5 Compaction

Each layer of the [ABC] [and] [GCA] shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus [\_\_\_\_\_] percent of the optimum water content determined from laboratory tests as specified in paragraph SAMPLING AND TESTING. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer has a degree of compaction that is at least [100] [\_\_\_\_\_] percent of laboratory maximum density through the full depth of the layer. The

Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory [ABC] [and] [GCA]. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

#### 3.5.6 Thickness

Compacted thickness of the aggregate course shall be [as indicated] [[\_\_\_\_\_] mm.] No individual layer shall exceed 150 mm nor be less than 75 mm in compacted thickness. The total compacted thickness of the [ABC] [and] [GCA] course shall be within 13 mm of the thickness indicated. Where the measured thickness is more than 13 mm deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 13 mm thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 6 mm of the thickness indicated. The total thickness of the [ABC] [and] [GCA] course shall be measured at intervals in such a manner as to ensure one measurement for each [500] [\_\_\_\_\_] square meters of base course. Measurements shall be made in 75 mm diameter test holes penetrating the base course.

#### 3.5.7 Proof Rolling

Proof rolling of the areas indicated shall be in addition to the compaction specified and shall consist of the application of 30 coverages with a heavy pneumatic-tired roller having four or more tires, each loaded to a minimum of 13,600 kg and inflated to a minimum of 1035 kPa. In areas designated, proof rolling shall be applied to the top of the underlying material on which [ABC] [and] [GCA] is laid and to each layer of [ABC] [and] [GCA]. Water content of the underlying material shall be maintained at optimum or at the percentage directed from start of compaction to completion of proof rolling of that layer. Water content of each layer of the [ABC] [and] [GCA] shall be maintained at the optimum percentage directed from start of compaction to completion of proof rolling. Any [ABC] [and] [GCA] materials or any underlying materials that produce unsatisfactory results by proof rolling shall be removed and replaced with satisfactory materials, recompacted and proof rolled to meet these specifications.

#### 3.5.8 Finishing

The surface of the top layer of [ABC] [and] [GCA] shall be finished after [final compaction] [and] [proof rolling] by cutting any overbuild to grade and rolling with a steel-wheeled roller. Thin layers of material shall not be added to the top layer of base course to meet grade. If the elevation of the top layer of [ABC] [and] [GCA] is 13 mm or more below grade, then the top layer should be scarified to a depth of at least 75 mm and new material shall be blended in [and compacted] [, compacted and proof rolled] to bring to grade. Adjustments to rolling and finishing procedures shall be made as directed to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the unsatisfactory portion shall be scarified, reworked and recompacted or it shall be replaced as directed.

#### 3.5.9 Smoothness

The surface of the top layer shall show no deviations in excess of 10 mm when tested with a [3.05] [3.66] meter straightedge. Measurements shall be taken in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at [15] [\_\_\_\_\_] meter intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

### 3.6 TRAFFIC

[Traffic shall not be allowed on the completed [ABC] [and] [GCA] course]. [Completed portions of the [ABC] [and] [GCA] course may be opened to limited traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.]

### 3.7 MAINTENANCE

The [ABC] [and] [GCA] shall be maintained in a satisfactory condition until the full pavement section is completed and accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any [ABC] [and] [GCA] that is not paved over prior to the onset of winter, shall be retested to verify that it still complies with the requirements of this specification. Any area of [ABC] [and] [GCA] that is damaged shall be reworked or replaced as necessary to comply with this specification.

### 3.8 DISPOSAL OF UNSATISFACTORY MATERIALS

Any unsuitable materials that must be removed shall be disposed of [as directed] [in waste disposal areas indicated]. No additional payments will be made for materials that must be replaced.

-- End of Section --

## SECTION 02748

BITUMINOUS TACK AND PRIME COATS  
01/98

## 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 basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO T 40 (1978; R 1983) Sampling Bituminous  
Materials

AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

ASTM D 140 (1993) Sampling Bituminous Materials

ASTM D 977 (1991) Emulsified Asphalt

ASTM D 2027 (1976; R 1992) Cutback Asphalt  
(Medium-Curing Type)

ASTM D 2397 (1994) Cationic Emulsified Asphalt

ASTM D 2995 (1993) Determining Application Rate of  
Bituminous Distributors

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-09 Reports

Tests; GA-RE.

Copies of all test results for bituminous materials, within 24 hours of completion of tests. Certified copies of the manufacturer's test reports indicating compliance with applicable specified requirements, not less than 30 days before the material is required in the work.

## 1.3 PLANT, EQUIPMENT, MACHINES AND TOOLS

## 1.3.1 General Requirements

Plant, equipment, machines and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times.

### 1.3.2 Bituminous Distributor

The distributor shall have pneumatic tires of such size and number to prevent rutting, shoving or otherwise damaging the base surface or other layers in the pavement structure. The distributor shall be designed and equipped to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled rates with an allowable variation from the specified rate of not more than plus or minus 5 percent, and at variable widths. Distributor equipment shall include a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. The distributor shall be equipped to circulate and agitate the bituminous material during the heating process.

### 1.3.3 Power Brooms and Power Blowers

Power brooms and power blowers shall be suitable for cleaning the surfaces to which the bituminous coat is to be applied.

## 1.4 WEATHER LIMITATIONS

Bituminous coat shall be applied only when the surface to receive the bituminous coat is dry. Bituminous coat shall be applied only when the atmospheric temperature in the shade is 10 degrees C or above and when the temperature has not been below 2 degrees C for the 12 hours prior to application.

## PART 2 PRODUCTS

### 2.1 TACK COAT

Emulsified asphalt shall conform to ASTM D 977 or ASTM D 2397, for Type ss-1, ss-1h, css-1, or css-1h.

### 2.2 PRIME COAT

Cutback asphalt shall conform to ASTM D 2027, Grade MC-30 or MC-70.

## PART 3 EXECUTION

### 3.1 PREPARATION OF SURFACE

Immediately before applying the bituminous coat, all loose material, dirt, clay, or other objectionable material shall be removed from the surface to be treated. The surface shall be dry and clean at the time of treatment.

### 3.2 APPLICATION RATE

The exact quantities within the range specified, which may be varied to suit field conditions, will be determined by the Contracting Officer.

#### 3.2.1 Tack Coat

Bituminous material for the tack coat shall be applied in quantities of not less than 0.20 liter nor more than 0.70 liter per square meter of

pavement surface.

3.2.2 Prime Coat

Bituminous material for the prime coat shall be applied in quantities of not less than 0.70 liter nor more than 1.80 liters per square meter of pavement surface.

3.3 APPLICATION TEMPERATURE

3.3.1 Viscosity Relationship

Asphalt application temperature shall provide an application viscosity between 10 and 60 seconds, Saybolt Furol, or between 20 and 120 square mm/sec, kinematic. The temperature viscosity relation shall be furnished to the Contracting Officer.

3.3.2 Temperature Ranges

The viscosity requirements shall determine the application temperature to be used. The following is a normal range of application temperatures:

Liquid Asphalts

[MC-30	29-87 degrees C]
[MC-70	50-107 degrees C]

Emulsions

[SS-1	20-70 degrees C]
[SS-1h	20-70 degrees C]
[CSS-1	20-70 degrees C]
[CSS-1h	20-70 degrees C]

\*These temperature ranges exceed the flash point of the material and care should be taken in their heating.

3.4 APPLICATION

Following preparation and subsequent inspection of the surface, the bituminous coat shall be applied at the specified rate with uniform distribution over the surface to be treated. All areas and spots missed by the distributor shall be properly treated with the hand spray. Until the succeeding layer of pavement is placed, the surface shall be maintained by protecting the surface against damage and by repairing deficient areas at no additional cost to the Government. If required, clean dry sand shall be spread to effectively blot up any excess bituminous material. No smoking, fires, or flames other than those from the heaters that are a part of the equipment shall be permitted within 8 meters of heating, distributing, and transferring operations of bituminous material other than bituminous emulsions. To obtain uniform application of the prime coat on the surface treated at the junction of previous and subsequent applications, building paper shall be spread on the surface for a sufficient distance back from the ends of each application to start and stop the prime coat on the paper. Immediately after application, the building paper shall be removed and destroyed.

### 3.5 CURING PERIOD

Following application of the bituminous material and prior to application of the succeeding layer of pavement, the bituminous coat shall be allowed to cure and to obtain evaporation of any volatiles or moisture. Prime coat shall be allowed to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course.

### 3.6 FIELD QUALITY CONTROL

Samples of the bituminous material used shall be obtained by the Contractor as directed, under the supervision of the Contracting Officer. The sample may be retained and tested by the Government at no cost to the Contractor.

### 3.7 SAMPLING AND TESTING

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved.

#### 3.7.1 Sampling

The samples of bituminous material, unless otherwise specified, shall be in accordance with ASTM D 140 or AASHTO T 40. Sources from which bituminous materials are to be obtained shall be selected and notification furnished the Contracting Officer within 15 days after the award of the contract.

#### 3.7.2 Calibration Test

The Contractor shall furnish all equipment, materials, and labor necessary to calibrate the bituminous distributor. Calibration shall be made with the approved job material and prior to applying the bituminous coat material to the prepared surface. Calibration of the bituminous distributor shall be in accordance with ASTM D 2995.

#### 3.7.3 Trial Applications

Before providing the complete bituminous coat, three lengths of at least 30 meters for the full width of the distributor bar shall be applied to evaluate the amount of bituminous material that can be satisfactorily applied.

##### 3.7.3.1 Tack Coat Trial Application Rate

Unless otherwise authorized, the trial application rate of bituminous tack coat materials shall be applied in the amount of 0.20 liters per square meter. Other trial applications shall be made using various amounts of material as may be deemed necessary.

##### 3.7.3.2 Prime Coat Trial Application Rate

Unless otherwise authorized, the trial application rate of bituminous materials shall be applied in the amount of 1.10 liters per square meter. Other trial applications shall be made using various amounts of material as may be deemed necessary.

#### 3.7.4 Sampling and Testing During Construction

Quality control sampling and testing shall be performed as required in paragraph FIELD QUALITY CONTROL.

-- End of Section --

## SECTION 02748A

BITUMINOUS TACK AND PRIME COATS  
01/98

## 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 basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 20	(1970; R 1996) Penetration Graded Asphalt Cement
AASHTO M 81	(1992; R 1996) Cut-Back Asphalt (Rapid-Curing Type)
AASHTO M 82	(1975; R 1996) Cut-Back Asphalt (Medium-Curing Type)
AASHTO M 226	(1980; R 1996) Viscosity Graded Asphalt Cement
AASHTO T 40	(1978; R 1996) Sampling Bituminous Materials

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 140	(200) Sampling Bituminous Materials
ASTM D 946	(1982; R 1999) Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 977	(1998) Emulsified Asphalt
ASTM D 1250	(1980; R 1997e1) Petroleum Measurement Tables
ASTM D 2026	(1972; R 1997) Cutback Asphalt (Slow-Curing Type)
ASTM D 2027	(1976; R 1997) Cutback Asphalt (Medium-Curing Type)
ASTM D 2028	(1976; R 1997) Cutback Asphalt (Rapid-Curing Type)
ASTM D 2397	(1998) Cationic Emulsified Asphalt
ASTM D 2995	(1999) Determining Application Rate of Bituminous Distributors

ASTM D 3381

(1992; R 1999) Viscosity-Graded Asphalt  
Cement for Use in Pavement Construction

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-03 Product Data

Waybills and Delivery Tickets G, FM-RI-MC

Waybills and delivery tickets, during progress of the work.

### SD-06 Test Reports

Sampling and Testing G, FM-RI-MC

Copies of all test results for bituminous materials, within 24 hours of completion of tests. Certified copies of the manufacturer's test reports indicating compliance with applicable specified requirements, not less than 30 days before the material is required in the work.

## 1.3 PLANT, EQUIPMENT, MACHINES AND TOOLS

### 1.3.1 General Requirements

Plant, equipment, machines and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times.

### 1.3.2 Bituminous Distributor

The distributor shall have pneumatic tires of such size and number to prevent rutting, shoving or otherwise damaging the base surface or other layers in the pavement structure. The distributor shall be designed and equipped to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled rates with an allowable variation from the specified rate of not more than plus or minus 5 percent, and at variable widths. Distributor equipment shall include a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. The distributor shall be equipped to circulate and agitate the bituminous material during the heating process.

### 1.3.3 Power Brooms and Power Blowers

Power brooms and power blowers shall be suitable for cleaning the surfaces to which the bituminous coat is to be applied.

## 1.4 WEATHER LIMITATIONS

Bituminous coat shall be applied only when the surface to receive the bituminous coat is dry. Bituminous coat shall be applied only when the atmospheric temperature in the shade is 10 degrees C or above and when the temperature has not been below 2 degrees C for the 12 hours prior to application.

## PART 2 PRODUCTS

### 2.1 TACK COAT

Emulsified asphalt shall conform to ASTM D 977, or ASTM D 2397, Grade CSS-1, CSS-1H, OR SS-1H.

### 2.2 PRIME COAT

Cutback asphalt shall conform to ASTM D 2027, Grade MC-30 OR MC-70.

## PART 3 EXECUTION

### 3.1 PREPARATION OF SURFACE

Immediately before applying the bituminous coat, all loose material, dirt, clay, or other objectionable material shall be removed from the surface to be treated. The surface shall be dry and clean at the time of treatment.

### 3.2 APPLICATION RATE

The exact quantities within the range specified, which may be varied to suit field conditions, will be determined by the Contracting Officer.

#### 3.2.1 Tack Coat

Bituminous material for the tack coat shall be applied in quantities of not less than 0.20 liter nor more than 0.70 liter per square meter of pavement surface.

#### 3.2.2 Prime Coat

Bituminous material for the prime coat shall be applied in quantities of not less than 0.70 liter nor more than 1.80 liters per square meter of pavement surface.

### 3.3 APPLICATION TEMPERATURE

#### 3.3.1 Viscosity Relationship

Asphalt application temperature shall provide an application viscosity between 10 and 60 seconds, Saybolt Furol, or between 20 and 120 square mm/sec, kinematic. The temperature viscosity relation shall be furnished to the Contracting Officer.

#### 3.3.2 Temperature Ranges

The viscosity requirements shall determine the application temperature to be used. The following is a normal range of application temperatures:

Liquid Asphalts  
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[SC-250	75-132 degrees C]
[MC-30	29-87 degrees C]
[MC-70	50-107 degrees C]
[MC-250	75-132 degrees C]
[RC-70	50-90 degrees C*]
[RC-250	75-12 degrees C*]

Paving Grade Asphalts

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Penetration Grades

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[200-300	plus 130 degrees C]
[120-150	plus 132 degrees C]
[85-100	plus 137 degrees C]

Viscosity Grades

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[AC 2.5	plus 132 degrees C]
[AC 5	plus 137 degrees C]
[AC 10	plus 137 degrees C]
[AR 1000	plus 135 degrees C]
[AR 2000	plus 140 degrees C]
[AR 4000	plus 143 degrees C]

Emulsions

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[RS-1	20-60 degrees C]
[MS-1	20-70 degrees C]
[HFMS-1	20-70 degrees C]
[SS-1	20-70 degrees C]
[SS-1h	20-70 degrees C]
[CRS-1	52-85 degrees C]
[CSS-1	20-70 degrees C]
[CSS-1h	20-70 degrees C]

\*These temperature ranges exceed the flash point of the material and care should be taken in their heating.

3.4 APPLICATION

3.4.1 General

Following preparation and subsequent inspection of the surface, the bituminous coat shall be applied at the specified rate with uniform distribution over the surface to be treated. All areas and spots missed by the distributor shall be properly treated with the hand spray. Until the succeeding layer of pavement is placed, the surface shall be maintained by protecting the surface against damage and by repairing deficient areas at no additional cost to the Government. If required, clean dry sand shall be spread to effectively blot up any excess bituminous material. No smoking, fires, or flames other than those from the heaters that are a part of the equipment shall be permitted within 8 meters of heating, distributing, and transferring operations of bituminous material other than bituminous

emulsions. All traffic, except for paving equipment used in constructing the surfacing, shall be prevented from using the underlying material, whether primed or not, until the surfacing is completed. The bituminous coat shall conform to all requirements as described herein.

#### 3.4.2 Prime Coat

The prime coat will be required if it will be at least seven days before a the surfacing (Asphalt cement hot mix concrete)layer is constructed on the underlying (base course, etc)compacted material. The type of liquid asphalt and application rate will be as specified herein. The Contractor shall protect the underlying from any damage (water, traffic, etc.) until the surfacing is placed. If the Contractor places the surfacing within seven days, the choice of protection measures or actions to be taken is at the Contractor's option. Damage to the underlying material caused by lack of, or inadequate, protection shall be repaired (recompacted or replaced) by approved methods at no additional cost to the Government. If the Contractor options to use the prime coat, it shall be applied as soon as possible after consolidation of the underlying material. To obtain uniform application of the prime coat on the surface treated at the junction of previous and subsequent applications, building paper shall be spread on the surface for a sufficient distance back from the ends of each application to start and stop the prime coat on the paper. Immediately after application, the building paper shall be removed and destroyed.

#### 3.4.3 Tack Coat

Tack coat shall be applied at the locations shown on the drawings.

#### 3.5 CURING PERIOD

Following application of the bituminous material and prior to application of the succeeding layer of pavement, the bituminous coat shall be allowed to cure and to obtain evaporation of any volatiles or moisture. Prime coat shall be allowed to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course.

#### 3.6 SAMPLING AND TESTING

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved.

##### 3.6.1 Sampling

The samples of bituminous material, unless otherwise specified, shall be in accordance with ASTM D 140. Sources from which bituminous materials are to be obtained shall be selected and notification furnished the Contracting Officer within 15 days after the award of the contract.

##### 3.6.2 Calibration Test

The Contractor shall furnish all equipment, materials, and labor necessary to calibrate the bituminous distributor. Calibration shall be made with the approved job material and prior to applying the bituminous coat material to the prepared surface. Calibration of the bituminous distributor shall be in accordance with ASTM D 2995.

### 3.6.3 Trial Applications

Before providing the complete bituminous coat, three lengths of at least 30 meters for the full width of the distributor bar shall be applied to evaluate the amount of bituminous material that can be satisfactorily applied.

#### 3.6.3.1 Tack Coat Trial Application Rate

Unless otherwise authorized, the trial application rate of bituminous tack coat materials shall be applied in the amount of 0.20 liters per square meter . Other trial applications shall be made using various amounts of material as may be deemed necessary.

#### 3.6.3.2 Prime Coat Trial Application Rate

Unless otherwise authorized, the trial application rate of bituminous materials shall be applied in the amount of 1.10 liters per square meter . Other trial applications shall be made using various amounts of material as may be deemed necessary.

### 3.6.4 Sampling and Testing During Construction

Quality control sampling and testing shall be performed as required in paragraph FIELD QUALITY CONTROL.

-- End of Section --

## SECTION 02753

## CONCRETE PAVEMENT FOR AIRFIELDS AND OTHER HEAVY-DUTY PAVEMENTS

03/97

## 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 basic designation only.

## AMERICAN CONCRETE INSTITUTE (ACI)

ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 214.3R	(1988) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results
ACI 305R	(1991) Hot Weather Concreting

## AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(1991) Burlap Cloth Made from Jute or Kenaf
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## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1995a) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 184	(1990) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 185	(1994) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 497	(1995) Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 615	(1996) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM A 616	(1995b) Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 617	(1995b) Axle-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM C 29	(1991a) Unit Weight and Voids in Aggregate
ASTM C 31	(1996) Making and Curing Concrete Test Specimens in the Field

ASTM C 33	(1993) Concrete Aggregates
ASTM C 78	(1994) Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C 94	(1996) Ready-Mixed Concrete
ASTM C 117	(1995) Materials Finer Than 75 Micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 123	(1994) Lightweight Pieces in Aggregate
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1995a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 142	(1978; R 1990) Clay Lumps and Friable Particles in Aggregates
ASTM C 143	(1990a) Slump of Hydraulic Cement Concrete
ASTM C 150	(1996) Portland Cement
ASTM C 171	(1995) Sheet Materials for Curing Concrete
ASTM C 172	(1990) Sampling Freshly Mixed Concrete
ASTM C 174	(1987; R 1991) Measuring Length of Drilled Concrete Cores
ASTM C 192	(1990a) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1991b) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(1995) Air-Entraining Admixtures for Concrete
ASTM C 295	(1990) Petrographic Examination of Aggregates for Concrete
ASTM C 330	(1989) Lightweight Aggregates for Structural Concrete
ASTM C 494	(1992) Chemical Admixtures for Concrete
ASTM C 595	(1995a) Blended Hydraulic Cements
ASTM C 618	(1996a) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral

Admixture in Portland Cement Concrete

ASTM C 881	(1990) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 989	(1994a) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1064	(1986; R 1993) Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1077	(1995a) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 1240	(1995) Silica Fume for Use in Hydraulic Cement Concrete and Mortar
ASTM D 449	(1989; R 1994) Asphalt Used for Dampproofing and Waterproofing
ASTM D 946	(1982; R 1993) Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 1227	(1987) Emulsified Asphalt Used as a Protective Coating for Roofing
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1992) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 3665	(1994) Practice for Random Sampling of Construction Materials

CALIFORNIA DEPARTMENT OF TRANSPORTATION (CDT)

CDT Test 526	(1978) Operation of California Profilograph and Evaluation of Profiles
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ARMY CORPS OF ENGINEERS (COE)

COE CRD-C 55	(1992) Test Method for Within-Batch Uniformity of Freshly Mixed Concrete
COE CRD-C 100	(1975) Method of Sampling Concrete Aggregate and Aggregate Sources, and Selection of Material for Testing
COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
COE CRD-C 114	(1994) Test Method for Soundness of Aggregates by Freezing and Thawing of

## Concrete Specimens

COE CRD-C 119	(1991) Standard Test Method for Flat or Elongated Particles in Coarse Aggregate
COE CRD-C 130	(1989) Scratch Hardness of Coarse Aggregates Particles
COE CRD-C 143	(1962) Specifications for Meters for Automatic Indication of Moisture in Fine Aggregate
COE CRD-C 171	(1995) Test Method for Determining Percentage of Crushed Particles in Aggregate
COE CRD-C 300	(1990) Specifications for Membrane-Forming Compounds for Curing Concrete
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete
COE CRD-C 540	(1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

## NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(1995) NIST Handbook 44: Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices
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## NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(1990) Concrete Plant Standards
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## 1.2 SYSTEM DESCRIPTION

This section is intended to stand alone for construction of concrete (rigid) pavement. However, where the construction covered herein interfaces with other sections, the construction at each interface shall conform to the requirements of both this section and the other section, including tolerances for both.

## 1.3 ACCEPTABILITY OF WORK

Concrete samples shall be taken by the Contractor in the field to determine the slump, air content, and strength of the concrete. Test beams and test cylinders shall be made for determining conformance with the strength requirements of these specifications. The air content shall be determined in accordance with ASTM C 231. Slump tests shall be made in accordance

with ASTM C 143. Test beams and cylinders shall be molded and cured in accordance with ASTM C 31 and as specified below. Steel molds shall be used for molding the specimens. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory. Laboratory curing facilities for test specimens shall include furnishing and operating water tanks equipped with temperature-control devices that will automatically maintain the temperature of the water at 23 plus or minus 3 degrees C. The Contractor shall furnish and maintain at the site boxes or other facilities suitable for storing the specimens while in the mold at a temperature of 23 plus or minus 6 degrees C. Tests of the fresh concrete and of the hardened concrete specimens shall be made by and at the expense of the Contractor.

#### 1.3.1 Pavement Lots

A lot will be that quantity of construction that will be evaluated for compliance with specification requirements. A lot will be equal to 8-hour's of production. In order to evaluate thickness and strength, each lot will be divided into four equal sublots. Grade and surface smoothness (and condition) determinations will be made on the lot as a whole. Edge slump requirements will be applied to each individual slab into which the primary paving lanes are divided by transverse joints. Samples for determining aggregate grading for fine aggregate and each size of coarse aggregate will be taken as the aggregate enters the weigh hoppers. Results of tests on aggregates shall be used to control aggregate production and concreting operations. Samples for determining air content and slump and for fabricating strength specimens shall be taken in accordance with ASTM C 172 during or immediately following delivery of the concrete at the paving site and deposition of the concrete immediately in front of the paver or transfer spreader. Results of strength tests shall be used to control concreting operations. Cores for thickness determination shall be drilled and evaluated as specified. Location of all samples shall be as directed and will be deliberately selected on a truly random basis, not haphazard, using commonly recognized methods of assuring randomness, employing randomizing tables or computer programs, in accordance with ASTM D 3665.

#### 1.3.2 Acceptance of Lots

When a lot of material fails to meet the specification requirements, that lot shall be removed and replaced at no additional cost to the Government.

#### 1.3.3 Evaluation

The Contractor shall provide facilities for and, where directed, personnel to assist in obtaining samples for any Government testing, all at no additional cost to the Government. Such testing will in no way relieve the Contractor of any specified testing responsibilities. The Contractor shall provide all sampling and testing required for acceptance and payment adjustment at its expense. Such sampling and testing shall be performed by a commercial testing laboratory inspected by the Government and approved in writing. The laboratory performing the tests shall be on-site and shall conform with ASTM C 1077. The individuals who sample and test concrete or the constituents of concrete as required in this specification shall be certified as American Concrete Institute (ACI) Concrete Field Testing Technicians, Grade I, or shall have otherwise demonstrated to the satisfaction of the Contracting Officer other training providing knowledge and ability equivalent to the ACI minimum requirements for certification. The individuals who perform the inspection of concrete shall be certified

as ACI Concrete Construction Inspector, Level II, or have otherwise demonstrated to the satisfaction of the Contracting Officer other training providing knowledge and ability equivalent to the ACI minimum requirements for certification. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per year thereafter for conformance with ASTM C 1077.

1.3.4 Additional Sampling and Testing

The Contracting Officer reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. Testing in these areas will be in addition to the subplot or lot testing, and the requirements for these areas will be the same as those for a subplot or lot.

1.3.5 Air Content Tests

Air content of the concrete shall be controlled as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL and will not be considered for payment adjustment.

1.3.6 Slump Tests

Slump of the concrete shall be controlled as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL and will not be considered for payment adjustment.

1.3.7 Surface Smoothness

The Contractor shall use one or both of the following methods to test and evaluate surface smoothness of the pavement. All testing shall be performed in the presence of the Contracting Officer's representative. Detailed notes shall be kept of the results of the testing and a copy furnished to the Government immediately after each day's testing. The profilograph method shall be used for all longitudinal and transverse testing, except where the runs would be less than 60 m in length and at the ends where the straightedge shall be used. Where drawings show required deviations from a plane surface (crowns, drainage inlets, etc.), the surface shall be finished to meet the approval of the Contracting Officer.

1.3.7.1 Smoothness Requirements

- a. Straightedge Testing: The finished surfaces of the pavements shall have no abrupt change of 3 mm or more, and all pavements shall be within the tolerances specified in Table 1 when checked with an approved 4 m straightedge.

TABLE 1  
STRAIGHTEDGE SURFACE SMOOTHNESS--PAVEMENTS

Pavement Category	Direction of Testing	Tolerances mm
Runways and Taxiways	Longitudinal	3
	Transverse	6.5
Calibration Hardstands & Compass Swinging Bases	Longitudinal	3
	Transverse	3

TABLE 1  
STRAIGHTEDGE SURFACE SMOOTHNESS--PAVEMENTS

Pavement Category	Direction of Testing	Tolerances mm
All Other Airfield and Helicopter Paved Areas	Longitudinal	6.5
	Transverse	6.5
Roads and Streets	Longitudinal	5
	Transverse	6.5
Tank Hardstands, Parking Areas, Open Storage Areas	Longitudinal	6.5
	Transverse	6.5

- b. Profilograph Testing: The finished surfaces of the pavements shall have no abrupt change of 3 mm or more, and all pavement shall have a Profile Index not greater than specified in Table 2 when tested with an approved California-type profilograph. If the extent of the pavement in either direction is less than 60 m, that direction shall be tested by the straightedge method and shall meet requirements specified for such.

TABLE 2  
PROFILOGRAPH SURFACE SMOOTHNESS--PAVEMENTS

Pavement Category	Direction of Testing	Maximum Specified Profile Index mm per km
Runways	Longitudinal	110
	Transverse	140
Taxiways	Longitudinal	140
	Transverse	(Use Straightedge)
Calibration Hardstands and Compass Swinging Bases		(Use Straightedge)
All Other Airfield and Helicopter Paved Areas	Longitudinal	140
	Transverse	140
Roads and Streets	Longitudinal	140
	Transverse	(Use Straightedge)
Tank Hardstands, Parking Areas, Open Storage Areas	Longitudinal	175
	Transverse	175

#### 1.3.7.2 Testing Method

After the concrete has hardened sufficiently to permit walking thereon, but not later than 36 hours after placement, the surface of the pavement in each entire lot shall be tested by the Contractor in such a manner as to reveal all surface irregularities exceeding the tolerances specified above.

Separate testing of individual sublots is not required. If any pavement areas are ground, these areas shall be retested immediately after grinding.

The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines. The transverse lines shall be 4.5 m or less apart, as directed. The longitudinal lines shall be at the centerline of each paving lane shown on the drawings, regardless of whether the Contractor is allowed to pave two lanes at a time, and at the 1/8th point in from each side of the lane. Other areas having obvious deviations shall also be tested. Longitudinal testing lines shall be continuous across all joints. Transverse testing lines for pilot lanes shall be carried to construction joint lines and for fill-in lanes shall be carried 600 mm across construction joints, and the readings in this area applied to the fill-in lane. Straightedge testing of the longitudinal edges of slipformed pilot lanes shall also be performed before paving fill-in lanes as specified in paragraph "Edge Slump and Joint Face Deformation".

- a. Straightedge Testing: The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length and measuring the maximum gap between the straightedge and the pavement surface, in the area between these two high points. Location and deviation from straightedge for all measurements shall be recorded. When 20 percent or more of the measurements exceeds the tolerance, the lot shall be removed and replaced at no additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 50 percent shall be corrected by grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.
- b. Profilograph Testing: Profilograph testing shall be performed using approved equipment and procedures described in CDT Test 526. The equipment shall utilize electronic recording and automatic computerized reduction of data to indicate "must-grind" bumps and the Profile Index for the pavement. The "blanking band" shall be 5 mm wide and the "bump template" shall span 25 mm with an offset of 10 mm. The profilograph shall be operated by an approved, factory-trained operator on the alignments specified above. A copy of the reduced tapes shall be furnished the Government at the end of each day's testing. Location and data from all profilograph measurements shall be recorded. When the Profile Index exceeds the tolerance by 63 mm per km or more, the lot shall be removed and replaced at not additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 79 mm per km or more, shall be corrected by grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.

#### 1.3.7.3 Bumps ("Must Grind Areas")

Bumps ("Must Grind" Areas): Any bumps ("must grind" areas) shown on the profilograph trace which exceed 10 mm in height shall be reduced by grinding in accordance with subparagraph "Areas Defective In Plan Grade Or Smoothness" until they do not exceed 7.5 mm when retested. Such grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. At the Contractor's option, pavement areas including ground areas may be rechecked with the profilograph in order to

record a lower Profile Index.

1.3.8 Edge Slump and Joint Face Deformation

The following requirements on testing and evaluation of edge slump and joint face deformation apply only to pavements 250 mm or more in thickness. Use of slip-form paving equipment and procedures that fail to consistently provide edges within the specified tolerances on edge slump and joint face deformation shall be discontinued and the pavements shall be constructed by means of standard paving procedures using fixed forms. Slabs having more than the allowable edge slump shall be removed and replaced as specified in subparagraph "Excessive Edge Slump" before the adjacent lane is placed. Edge slump and joint face deformation will not be applied to payment adjustment.

1.3.8.1 Edge Slump

When slip-form paving is used, not more than 15.0 percent of the total free edge of any slab of the pavement, as originally constructed, shall have an edge slump exceeding 6 mm, and no slab shall have an edge slump exceeding 9 mm as determined in accordance with the measurements as specified in paragraph "Determination of Edge Slump". (The total free edge of the pavement will be considered to be the cumulative total linear measurement of pavement edge originally constructed as non-adjacent to any existing pavement; i.e., 30 m of pilot lane, a paving lane originally constructed as a separate lane, will have 60 m of free edge; 30 m of fill-in lane will have no free edge, etc.,). The area affected by the downward movement of the concrete along the pavement edge shall not exceed 450 mm back from the edge.

1.3.8.2 Joint Face Deformation

In addition to the edge slump limits specified above, the vertical joint face shall have a surface within the maximum limits shown below:

Offset from Straightedge Applied Longitudinally To Pavement Surface 25 mm Back From Joint Line	Offset from Straightedge Applied Longitudinally To Vertical Face	Offset From Straightedge Applied Vertically	Abrupt Offset in Any Direction	Offset of Joint Face from True Vertical	
Airfield Pavement	3 mm	6 mm	9 mm	3 mm	8 mm per 100 mm
All other Pavement	6 mm	All other items same as airfield pavement.			

1.3.8.3 Determination of Edge Slump

Immediately after the concrete has hardened sufficiently to permit walking thereon, the pavement surface shall be tested by the Contractor in the presence of a representative of the Contracting Officer. Testing shall be performed with a straightedge to reveal irregularities exceeding the edge slump tolerance specified above. The edge slump shall be determined at each free edge of each slipformed paving lane constructed. The

straightedge shall be placed transverse to the direction of paving and the end of the straightedge located at the edge of the paving lane. Measurements shall be made at 1.5 to 4.5 m spacings, as directed, commencing at the header where paving was started. Initially measurements shall be made at 1.5 m intervals in each lane. When no deficiencies are present, the Contracting Officer may approve an increase in the interval. When any deficiencies exist, the interval will be returned to 1.5 m. In no case shall the interval exceed 4.5 m. In addition to the transverse edge slump determination above, the Contractor, at the same time, shall check the longitudinal surface smoothness of the joint on a continuous line 25 mm back from the joint line using the straightedge advanced one-half its length for each reading. Other tests of the exposed joint face shall be made as directed to ensure that a uniform, true vertical joint face is attained. These tests shall include longitudinal straightedge testing of the vertical face and vertical testing of the face for both smoothness and angle. The measurements shall be made by the Contractor, shall be properly referenced in accordance with paving lane identification and stationing, and a report given to the Contracting Officer within 24 hours after measurement is made. The report shall also identify areas requiring replacement in accordance with paragraph "Excessive Edge Slump" as well as the cumulative percentage of total free edge of pavement constructed to date which has an edge slump exceeding 6 mm.

#### 1.3.8.4 Excessive Edge Slump

When edge slump exceeding the limits specified above is encountered on either side of the paving lane, additional straightedge measurements shall be made, if required, to define the linear limits of the excessive slump. The concrete for the entire width of the paving lane within these limits of excessive edge slump or joint deformation shall be removed and replaced in conformance with paragraph REPAIR, REMOVAL, REPLACEMENT OR SLABS. Partial slabs removed and replaced shall extend across the full width of the pavement lane, parallel to the transverse joints, and both the section of the slab removed and the section remaining in place shall have a minimum length of 3 m to the nearest scheduled transverse joint. If less than 3 m remains, the entire slab shall be removed and replaced. Adding concrete or paste to the edge or otherwise manipulating the plastic concrete after the sliding form has passed, or patching the hardened concrete, shall not be used as a method for correcting excessive edge slump.

#### 1.3.9 Plan Grade

##### 1.3.9.1 General

The finished surfaces of pavements shall conform, within the tolerances shown below, to the lines, grades, and cross sections shown. The finished surfaces of airfield runway, taxiway, and apron pavements shall vary not more than 12 mm above or below the plan grade line or elevation indicated.

The surfaces of other pavements shall vary not more than 18 mm. Plan grade shall be checked on the lot as a whole. In any areas where the deviation from grade exceeds the specified tolerances by 30 percent or more, the deficient area shall be removed and replaced at no additional cost to the Government. The finished surfaces of new abutting pavements shall coincide at their juncture.

##### 1.3.9.2 Grade Conformance Tests

Each pavement category shall be checked by the Contractor for conformance with plan grade requirements. For the purpose of making grade conformance

tests, the pavements will be subdivided into the same lots used for all other payment adjustment items. Within 5 days after paving of each lot, the finished surface of the pavement area in each lot shall be tested by the Contractor, in the presence of a representative of the Contracting Officer, by running lines of levels at intervals corresponding with every longitudinal and transverse joint to determine the elevation at each joint intersection. The results of this survey shall be recorded and a copy given to the Government at the completion of the survey of each lot.

#### 1.3.10 Flexural Strength

Each lot of pavement will be evaluated for acceptance in accordance with the following procedures. The Contractor shall be responsible for all testing required herein. Testing shall be performed by an approved commercial laboratory.

##### 1.3.10.1 Sampling and Testing

One composite sample of concrete from each subplot shall be obtained in accordance with ASTM C 172 from one batch or truckload. Test cylinders, 152 x 305 mm shall be fabricated and cured in accordance with ASTM C 31; and tested in accordance with ASTM C 39. At the same time 2 additional test cylinders to be used for CQC tests shall be fabricated and cured.

##### 1.3.10.2 Computations

The following computations shall be performed:

#### 1.3.11 Thickness

Each lot of pavement will be evaluated for acceptance in accordance with the following procedure. The Contractor shall be responsible for drilling the cores, measuring the cores in the presence of the Contracting Officer's representative, and for filling the core holes as directed.

##### 1.3.11.1 Drilling, Measuring, and Computations

Two cores, between 75 and 150 mm in diameter, shall be drilled from the pavement, per subplot (8 per lot). The Contractor shall fill the core holes with concrete containing an expanding admixture, as directed. The cores shall be evaluated for thickness of the pavement in accordance with ASTM C 174. The pavement thickness from the 8 cores for the lot shall be averaged and the standard deviation for the 8 thickness measurements shall be computed. The Characteristic Thickness for the lot shall be computed as follows:

$$\text{Characteristic Thickness} = y - 0.84 \times s \quad \text{where}$$

$y$  = average thickness from the 8 cores      and  
 $s$  = standard deviation of the 8 cores

##### 1.3.11.2 Evaluation for Thickness

Where the Characteristic Thickness for a lot show a thickness deficiency of 19 mm or more for pavements exceeding 200 mm, or 13 mm for pavements 200 mm or less in thickness, the entire lot shall be removed and replaced at no

additional cost to the Government. Where either of the two cores from a subplot show a thickness deficiency of 19 mm or greater, two more cores shall be drilled in the subplot and the average thickness of the four cores computed. If this average shows a thickness deficiency of 19 mm or more for pavements exceeding 200 mm, or 13 mm for pavements 200 mm or less in thickness, the entire subplot shall be removed.

#### 1.3.12 Partial Lots

When operational conditions cause a lot to be terminated before the specified four sublots have been completed, the following procedure shall be used to adjust the lot size and number of tests for the lot. Where three sublots have been completed, they shall constitute a lot and acceptance criteria adjusted accordingly. Where one or two sublots have been completed, they shall be incorporated into the next lot or the previous lot, as directed, and the total number of sublots shall be used and acceptance criteria adjusted accordingly.

#### 1.3.13 Areas Defective in Plan Grade or Smoothness

In areas not meeting the specified limits for surface smoothness and plan grade, high areas shall be reduced to attain the required smoothness and grade, except as depth is limited below. High areas shall be reduced either by hand rubbing the freshly finished concrete with a silicon carbide brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 14 days or more old. Rubbing with a silicon carbide brick and water shall be discontinued as soon as contact with the coarse aggregate is made, and all further necessary reduction shall be accomplished by grinding the hardened concrete with a surface-grinding machine after it is 14 days old. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and shall not exceed 1 percent of the total area of any subplot. The depth of grinding shall not exceed 6 mm. All pavement areas requiring plan grade or surface smoothness corrections in excess of the limits specified above, shall be removed and replaced in conformance with paragraph REPAIR, REMOVAL, REPLACEMENT OF SLABS. In pavement areas given a wire comb or tined texture, areas exceeding 2 square meters that have been corrected by rubbing or grinding shall be re textured by transverse grooving using an approved grooving machine of standard manufacture. The grooves shall be 3 mm deep by 6 mm wide on 50 mm centers and shall be carried into, and tapered to zero depth within the non-corrected surface. All areas in which rubbing or grinding has been performed will be subject to the thickness tolerances specified in paragraph Thickness. Any rubbing or grinding performed on individual slabs with excessive deficiencies shall be performed at the Contractor's own decision without entitlement to additional compensation if eventual removal of the slab is required.

#### 1.4 ACCEPTABILITY OF WORK

The materials and the pavement itself will be accepted on the basis of tests made by the Government and by the Contractor or the suppliers, all as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing. If the results of the Government and Contractor tests vary by less than 2.0 percent, of the Government's test results, the results of the Contractor's tests will be used. If the results of the Government and Contractor tests vary by 2.0 percent or more, but less than 4.0 percent, the average of the two will be considered the value to be used. If these vary by 4.0 percent or more,

each sampling and testing procedure shall be carefully evaluated and both the Government and the Contractor shall take another series of tests on duplicate samples of material. If these vary by 4.0 percent or more, the results of the tests made by the Government shall be used and the Government will continue check testing of this item on a continuous basis until the two sets of tests agree within less than 4.0 percent on a regular basis. Testing performed by the Government will in no way at any time relieve the Contractor from the specified testing requirements.

#### 1.5 PRECONSTRUCTION TESTING OF MATERIALS

The Contractor shall not be entitled to any additional payment or extension of time because of delays caused by sampling and testing additional sources, or samples, necessitated by failure of any samples.

##### 1.5.1 Aggregates

Aggregates shall be produced from the sources listed in SPECIAL CLAUSES or from another source when approved in accordance with SPECIAL CLAUSES and the technical provisions herein. If the Contractor proposes to furnish aggregates from a source not listed, the Government will make such tests and other investigations as necessary to determine whether or not aggregates meeting the requirements of this project can be produced from the proposed source. Tests will be conducted by and at the expense of the Government. The Contractor may designate only a single source or combination of sources for aggregate for testing by and at the expense of the Government. The Contractor will be entitled to no additional compensation or extension of time due to any requirements for sampling and testing of aggregates. The tests to which the aggregates will be subjected may include specific gravity, absorption, Los Angeles abrasion, soundness in magnesium sulfate, petrographic analysis, freezing and thawing in concrete, alkali or carbon-aggregate reaction, organic impurities, and any other tests that are necessary to demonstrate that concrete of acceptable quality can be produced from the materials proposed. When the Contractor desires to use aggregates from a source not listed, suitable samples for quality evaluation consisting of not less than 681 kg of each size coarse aggregate and 681 kg of fine aggregate shall be taken under the supervision of the Contracting Officer in accordance with COE CRD-C 100 and shall be delivered to the Materials Testing Center (MTC), U.S. Army Engineer Waterways Experiment Station, ATTN: CEWES-GS, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199, within 15 days after the Notice to Proceed. Sampling and shipping of samples shall be at the Contractor's expense. A maximum of 90 days will be required to complete evaluation of the aggregates.

##### 1.5.2 Epoxy-Resin Material

At least 30 days before the material is used, the Contractor shall submit certified copies of test results showing that the specific lots or batches from which the material will be furnished to this project have been tested by the manufacturer and that the material conforms to the requirements of these specifications.

##### 1.5.3 Cements and Pozzolans

Preconstruction sampling and testing of cement and pozzolan shall conform to the requirements specified for sampling and testing during construction except that test results showing that each material meets specification requirements shall be available at least 5 days before start of paving

operations.

## 1.6 TESTING BY CONTRACTOR DURING CONSTRUCTION

### 1.6.1 General

During construction, the Contractor shall be responsible for sampling and testing aggregates, cementitious materials (cement and pozzolan), and concrete to determine compliance with the specifications. All sampling and testing shall be performed by an approved commercial laboratory, or for cementitious materials, the manufacturer's laboratory. Samples of aggregate shall be obtained at the weigh hopper. Samples of concrete shall be obtained at the point of delivery to the paver. The Government will sample and test concrete and ingredient materials as considered appropriate. The Contractor shall provide facilities and labor as may be necessary for procurement of representative test samples. Testing by the Government will in no way relieve the Contractor of the specified testing requirements.

### 1.6.2 Cementitious Materials

Cement and pozzolan will be accepted on the basis of manufacturer's certification of compliance, accompanied by mill test reports showing that the material in each shipment meets the requirements of the specification under which it is furnished. No cementitious material shall be used until notice of acceptance has been given by the Contracting Officer. Cementitious material may be subjected to check testing by the Government from samples obtained at the mill, at transfer points, or at the project site.

## 1.7 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Equipment; GA-RE.

- a. Details and data on the batching and mixing plant prior to plant assembly including manufacturer's literature showing that the equipment meets all requirements specified herein.
- b. A description of the equipment proposed for transporting concrete mixture from the central mixing plant to the paving equipment at least 7 days prior to start of paving unless otherwise specified.
- c. At the time the materials are furnished for the mixture proportioning study, a description of the equipment proposed for the placing of the concrete mixture, method of control, and manufacturer's literature on the paver and finisher, together with the manufacturer's written instructions on adjustments and operating procedures necessary to assure a tight, smooth surface on the concrete pavement, free of tears and other surface imperfections, including excessive paste on the surface. The literature shall show that the equipment meets all details of these specifications.

Work Plan; GA-KC.

- a. A description of the placing and protection methods proposed prior to construction of the test section, if concrete is to be placed in or exposed to hot or cold weather conditions.
- b. A detailed plan of the proposed paving pattern showing all planned construction joints. No deviation from the jointing pattern shown on the drawings shall be made without written approval of the KC District Geotechnical Branch.
- c. Data on the curing media and methods to be used.

SD-08 Statements

Samples for Mixture Proportioning Studies; GA-KC.

The results of the Contractor's mixture proportioning studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of concrete at least 14 days prior to commencing concrete placing operations. Aggregate quantities shall be based on the mass in a saturated surface dry condition. The statement shall be accompanied by test results from an independent commercial testing laboratory, inspected by the Government, and approved in writing, showing that mixture proportioning studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture proportions without additional tests to show that the quality of the concrete is satisfactory.

SD-09 Reports

Sampling and Testing; GA-KC.

Certified copies of laboratory test reports, including all test data, for cement, pozzolan, aggregate, admixtures, and curing compound proposed for use on this project. These tests shall be made by an approved commercial laboratory or by a laboratory maintained by the manufacturers of the materials. No material shall be used until notice of acceptance has been given. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site.

SD-18 Records

Delivery, Storage, and Handling of Materials; FIO-RE.

Copies of waybills or delivery tickets for cementitious material during the progress of the work. Before the final payment is allowed, waybills and certified delivery tickets shall be furnished for all cementitious material used in the construction.

## 1.8 QUALIFICATIONS

All Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades (or shall have approved written evidence of having

completed similar qualification programs):

Concrete Field Testing Technician, Grade I  
 Concrete Laboratory Testing Technician, Grade I or II  
 Concrete Construction Inspector, Level II

The foreman or lead journeyman of the finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher, or equal. Written documentation shall be furnished for each workman in the above groups.

## 1.9 DELIVERY, STORAGE, AND HANDLING OF MATERIALS

### 1.9.1 Bulk Cementitious Materials

All cementitious material shall be furnished in bulk. The temperature of the cementitious material, as delivered to storage at the site, shall not exceed 65 degrees C.

#### 1.9.1.1 Transportation

When bulk cementitious material is not unloaded from primary carriers directly into weather-tight hoppers at the batching plant, transportation from the rail head, mill, or intermediate storage to the batching plant shall be accomplished in adequately designed weather-tight trucks, conveyors, or other means that will protect the cementitious material from exposure to moisture.

#### 1.9.1.2 Storage Requirements

Immediately upon receipt at the site of the work, cementitious materials shall be stored in a dry and properly ventilated structure. All storage facilities shall be subject to approval and shall allow easy access for inspection and identification. Sufficient cementitious materials shall be in storage to sustain continuous operation of the concrete mixing plant while the pavement is being placed. To prevent cement from becoming unduly aged after delivery, any cement that has been stored at the site for 60 days or more shall be used before using cement of lesser age.

#### 1.9.1.3 Separation of Materials

Separate facilities shall be provided which will prevent any intermixing during unloading, transporting, storing, and handling of each type of cementitious material.

### 1.9.2 Aggregate Materials

#### 1.9.2.1 Storage

Aggregate shall be stored at the site of the batching and mixing plant avoiding breakage, segregation, or contamination by foreign materials. Each size of aggregate from each source shall be stored separately in free-draining stockpiles. Fine aggregate and the smallest size coarse aggregate shall remain in free-draining storage for at least 24 hours immediately prior to use. Sufficient aggregate shall be maintained at the site at all times to permit continuous uninterrupted operation of the mixing plant at the time concrete pavement is being placed.

#### 1.9.2.2 Handling

Aggregate shall be handled avoiding segregation or degradation. Vehicles used for stockpiling or moving aggregate shall be kept clean of foreign materials. Tracked equipment shall not be allowed on coarse aggregate stockpiles. Stockpiles shall be built up and worked avoiding segregation in the piles and preventing different sizes of aggregate from being mixed during storage or batching. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed and unused.

### 1.9.3 Other Materials

Reinforcing bars and accessories shall be stored above the ground on platforms, skids, or other supports. Other materials shall be stored avoiding contamination and deterioration. Chemical admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. The Contractor shall ensure that materials can be accurately identified after bundles or containers are opened.

## 1.10 EQUIPMENT

All plant, equipment, tools, and machines used in the work shall be maintained in satisfactory working conditions at all times.

### 1.10.1 Batching and Mixing Plant

#### 1.10.1.1 Location of Batching and Mixing Plant

The batching and mixing plant shall be located off Government promises no more than 15 minutes haul time from the placing site. There shall be operable telephonic or radio communication between the batching plant and the placing site at all times concreting is taking place.

#### 1.10.1.2 Type and Capacity of Batching and Mixing Plant

The batching and mixing plant shall be a stationary-type plant. The plant shall be designed and operated to produce concrete within the specified tolerances, and shall have a capacity of at least 200 cubic meters per hour. The batching plant shall conform to the requirements of NRMCA CPMB 100 and as specified; however, rating plates attached to batch plant equipment are not required.

#### 1.10.1.3 Equipment Requirements

The batching controls shall be either semiautomatic or automatic. Semiautomatic batching system shall be provided with interlocks. Separate bins or compartments shall be provided for each size group of aggregate and each cementitious material. Aggregates shall be weighed either in separate weigh batchers with individual scales or cumulatively in one weigh batcher on one scale, provided the fine aggregate is weighed first. Aggregate shall not be weighed in the same batcher with cementitious material. If both cement and pozzolan are used, they may be batched cumulatively, provided portland cement is batched first. Water shall not be weighed or measured cumulatively with another ingredient. Water batcher filling and discharging valves shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. An accurate mechanical device for measuring and dispensing each chemical admixture shall be provided. Each dispenser shall be interlocked with the batching cycle and

discharged automatically to obtain uniform distribution throughout the batch in the specified mixing period. Different chemical admixtures shall not be combined before introduction in water and cement. The plant shall be arranged to facilitate the inspection of all operations at all times. Suitable facilities shall be provided for obtaining representative samples of aggregates from each bin or compartment.

1.10.1.4 Scales

Adequate facilities shall be provided for the accurate measurement and control of each of the materials entering each batch of concrete. The weighing equipment shall conform to the applicable requirements of NIST HB 44, except that the accuracy shall be within 0.2 percent of scale capacity. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring device. Each weighing unit shall include a visible springless dial, which shall indicate the scale load at all stages of the weighing operation or shall include a beam scale with a beam balance indicator that will show the scale in balance at zero load and at any beam setting. The indicator shall have an over and under travel equal to at least 5 percent of the capacity of the beam. Approved electronic digital indicators and load cells may also be used. The weighing equipment shall be arranged to allow the concrete plant operator to conveniently observe the dials or indicators.

1.10.1.5 Batching Tolerances

The following tolerances shall apply.

Materials	Percentage of Required Mass
Cement (and Pozzolan)	plus or minus 1
Aggregate	plus or minus 2
Water	plus or minus 1
Admixture	plus or minus 3

For volumetric batching equipment for water and admixtures, the above numeric tolerances shall apply to the required volume of material being batched. Concentrated admixtures shall be uniformly diluted, if necessary, to provide sufficient volume per batch to ensure that the batchers will consistently operate within the above tolerance.

1.10.1.6 Moisture Control

The plant shall be capable of ready adjustment to compensate for the varying moisture contents of the aggregates and to change the quantities of the materials being batched.

1.10.1.7 Recorders

A graphic or digital recorder conforming to the requirements of NRMCA CPMB 100 shall be furnished and kept operational at the batching plant.

1.10.2 Concrete Mixers

Mixers shall be stationary, or truck mixers if approved in writing. Truck mixers shall not be used for mixing or transporting paving concrete for

slip-form paving operations. Mixers shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The mixers shall not be charged in excess of the capacity recommended by the manufacturer. The mixers shall be operated at the drum or mixing blade speed designated by the manufacturer. The mixers shall be maintained in satisfactory operating condition, and the mixer drums shall be kept free of hardened concrete. Mixer blades or paddles shall be replaced when worn down more than 10 percent of their depth when compared with the manufacturer's dimension for new blades or paddles.

#### 1.10.2.1 Stationary, Central Plant, Mixers

Stationary mixers shall be provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed.

#### 1.10.2.2 Truck Mixers

The only truck mixers used for mixing or transporting paving concrete shall be those designed with extra large blading and rear opening specifically for low-slump paving concrete. Truck mixers, the mixing of concrete therein, and concrete uniformity shall conform to the requirements of ASTM C 94. A truck mixer may be used either for complete mixing (transit-mixed) or to finish the partial mixing done in a stationary mixer (shrink-mixed). Each truck shall be equipped with two counters which will show the number of revolutions at mixing speed and the number of revolutions at agitating speed. Concrete completely mixed in a truck mixer shall be mixed 70 to 100 revolutions at the designated mixing speed after all ingredients, including mixing water, have been charged into the drum. Concrete first partially mixed in a concrete plant mixer (shrink-mixed) a minimum time, as required to combine the ingredients, shall then be completely mixed in a truck mixer. The number of revolutions between 70 to 100 for truck-mixed concrete and the number of revolutions for shrink-mixed concrete shall be determined by uniformity tests as specified in ASTM C 94 and in requirements for mixer performance stated in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL. If requirements for the uniformity of concrete are not met with 100 revolutions of mixing after all ingredients including water are in the truck mixer drum, the mixer shall not be used until the condition is corrected. Additional revolutions beyond the number determined to produce the required uniformity shall be at the designated agitating speed. Water shall not be added after the initial introduction of mixing water except, when on arrival at the job site, the slump is less than specified and the water-cement ratio is less than that given as a maximum in the approved mixture. Additional water may be added to bring the slump within the specified range provided the approved water-cement ratio is not exceeded. Water shall be injected into the head of the mixer (end opposite the discharge opening) drum under pressure, and the drum or blades shall be turned a minimum of 30 additional revolutions at mixing speed. Water shall not be added to the batch at any later time.

#### 1.10.2.3 Mixing Time and Uniformity

- a. Stationary Mixers: For stationary mixers, before uniformity data are available, the mixing time for each batch after all solid materials are in the mixer, provided that all of the mixing water is introduced before one-fourth of the mixing time has elapsed, shall be 1 minute for mixers having a capacity of 0.75 cubic meter. For mixers of greater capacity, this minimum time shall be increased 20 seconds for each additional cubic meter or fraction thereof. After results of uniformity tests are available, the

mixing time may be reduced to the minimum time required to meet uniformity requirements; but if uniformity requirements are not being met, the mixing time shall be increased as directed. Mixer performance tests at new mixing times shall be performed immediately after any change in mixing time. When regular testing is performed, the concrete shall meet the limits of any five of the six uniformity requirements listed in Table 4, below. When abbreviated testing is performed, the concrete shall meet only those requirements listed for abbreviated testing. The concrete proportions used for uniformity tests shall be as used on the project. Regular testing shall consist of performing all six tests on three batches of concrete. The range for regular testing shall be the average of the ranges of the three batches. Abbreviated testing shall consist of performing the three required tests on a single batch of concrete. The range for abbreviated testing shall be the range for one batch. If more than one mixer is used and all are identical in terms of make, type, capacity, condition, speed of rotation, etc., the results of tests on one of the mixers shall apply to the others, subject to the approval of the Contracting Officer. All mixer performance (uniformity) testing shall be performed by the Contractor in accordance with COE CRD-C 55 and with paragraph titled TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL.

TABLE 4  
UNIFORMITY REQUIREMENTS--STATIONARY MIXERS

Parameter	Regular Tests Allowable Maximum Range for Average of 3 Batches	Abbreviated Tests Allowable Maximum Range for 1 Batch
Unit weight of air-free mortar, kg/cubic meter	32	32
Air content, percent	1.0	--
Slump, mm	25	--
Coarse aggregate, percent	6.0	6.0
Compressive strength at 7 days, percent	10.0	10.0
Water content, percent	1.5	--

- b. Truck Mixers: Mixer performance (uniformity) tests for truck mixers shall be made by the Contractor in accordance with ASTM C 94.

1.10.3 Transporting Equipment

Concrete shall be transported to the paving site in nonagitating equipment conforming to ASTM C 94 in approved truck mixers designed with extra large blading and rear opening specifically for low slump concrete or in approved agitators. All transporting equipment shall be designed and operated to deliver and discharge the required concrete mixture completely without segregation.

#### 1.10.4 Transfer and Spreading Equipment

Equipment for transferring concrete from the transporting equipment to the paving lane in front of the paver shall be specially manufactured, self-propelled transfer equipment which will accept the concrete outside the paving lane and will transfer and spread it evenly across the paving lane in front of the paver and strike off the surface evenly to a depth which permits the paver to operate efficiently.

#### 1.10.5 Paver-Finisher

The paver-finisher shall be a heavy-duty, self-propelled machine designed specifically for paving and finishing high quality pavement. The paver-finisher shall weigh at least 3280 kg per m of lane width, and shall be powered by an engine having at least 15,000 W per meter of lane width. The paver-finisher shall spread, consolidate, and shape the plastic concrete to the desired cross section in one pass. The mechanisms for forming the pavement shall be easily adjustable in width and thickness and for required crown. In addition to other spreaders required by paragraph Transfer and Spreading Equipment, the paver-finisher shall be equipped with a full width knock-down auger or paddle mechanism, capable of operating in both directions, which will evenly spread the fresh concrete in front of the screed or extrusion plate. Immersion vibrators shall be gang mounted at the front of the paver on a frame equipped with suitable controls so that all vibrators can be operated at any desired depth within the slab or completely withdrawn from the concrete, as required. The vibrators shall be automatically controlled so that they will be immediately stopped as forward motion of the paver ceases. The spacing of the immersion vibrators across the paving lane shall be as necessary to properly consolidate the concrete, but the clear distance between vibrators shall not exceed 750 mm. Spud vibrators shall operate at a frequency of not less than 135 Hz and an amplitude of not less than 0.75 mm and tube vibrators at a frequency of not less than 80 Hz and an amplitude of not less than 0.75 mm, as determined by COE CRD-C 521. The paver-finisher shall be equipped with a transversely oscillating screed or an extrusion plate to shape, compact, and smooth the surface and shall so finish the surface that no significant amount of hand finishing, except use of cutting straightedges, is required. The screed or extrusion plate shall be constructed to provide adjustment for crown in the pavement. The entire machine shall provide adjustment for variation in lane width or thickness and to prevent more than 200 mm of the screed or extrusion plate extending over previously placed concrete on either end when paving fill-in lanes. Machines that cause displacement of properly installed forms or cause ruts or indentations in the prepared underlying materials and machines that cause frequent delays due to mechanical failures shall be replaced as directed.

##### 1.10.5.1 Paver-Finisher with Fixed Forms

The paver-finisher shall be equipped with wheels designed to keep it aligned with the forms and to spread the load so as to prevent deformation of the forms.

##### 1.10.5.2 Slipform Paver-Finisher

The slipform paver-finisher shall be automatically controlled and crawler mounted with four padded tracks so as to be completely stable under all operating conditions. The paver-finisher shall finish the surface and edges so that no edge slump beyond allowable tolerance occurs. Horizontal alignment shall be electronically referenced to a taut wire guideline.

Vertical alignment shall be electronically referenced on both sides of the paver to a taut wire guideline, to an approved laser control system, or, only where permitted by paragraph Slipform Paving, to a ski operating on a completed lane. Suitable moving side forms shall be provided that are adjustable and will produce smooth, even edges, perpendicular to the top surface and meeting specification requirements for alignment and freedom from edge slump.

#### 1.10.5.3 Longitudinal Mechanical Float

A longitudinal mechanical float shall be specially designed and manufactured to smooth and finish the pavement surface without working excess paste to the surface. It shall be rigidly attached to the rear of the paver-finisher or to a separate self-propelled frame spanning the paving lane. The float plate shall be at least 1.5 m long by 200 mm wide and shall automatically be oscillated in the longitudinal direction while slowly moving from edge to edge of the paving lane, with the float plate in contact with the surface at all times.

#### 1.10.5.4 Nonrotating Pipe Float

A pipe float if used, shall be a nonrotating pipe 150 to 250 mm in diameter and sufficiently long to span the full paving width when oriented at an angle of approximately 1.05 rad with the centerline. The pipe float shall be mounted on a self-propelled frame that spans the paving lane. No means of applying water to the surface shall be incorporated in the pipe float.

#### 1.10.5.5 Other Types of Finishing Equipment

Clary screeds or other rotating tube floats, or bridge deck finishers, shall not be allowed on the project. Concrete finishing equipment of types other than specified above may be demonstrated on a test section outside the production pavement if approved in writing. If the Contracting Officer's representative decides from evaluation of the test section that the equipment is better than the specified finishing equipment, its use will be permitted as long as it continues to perform better than the specified equipment.

#### 1.10.6 Curing Equipment

Equipment for applying membrane-forming curing compound shall be mounted on a self-propelled frame that spans the paving lane. The reservoir for curing compound shall be constantly mechanically (not air) agitated during operation and shall contain means for completely draining the reservoir. The spraying system shall consist of a mechanically powered pump which will maintain constant pressure during operation, an operable pressure gauge, and either a series of spray nozzles evenly spaced across the lane to give uniformly overlapping coverage or a single spray nozzle which is mounted on a carriage which automatically traverses the lane width at a speed correlated with the forward movement of the overall frame. All spray nozzles shall be protected with wind screens. Any hand-operated sprayers allowed by paragraph Membrane Curing shall be compressed air supplied by a mechanical air compressor. If the curing machine fails to apply an even coating of compound at the specified rate, it shall immediately be replaced.

#### 1.10.7 Texturing Equipment

Texturing equipment shall be as specified below. Before use, the texturing

equipment shall be demonstrated on a test section, and the equipment shall be modified as necessary to produce the texture directed.

#### 1.10.7.1 Fabric Drag

A fabric drag shall consist of a piece of material as long as the lane width securely attached to a separate wheel mounted frame spanning the paving lane or to one of the other similar pieces of equipment. Width of the material shall provide 300 to 450 mm dragging flat on the pavement surface. Length shall be at least equal to the width of the slab plus 600 mm. The material shall be clean, reasonably new burlap, completely saturated with water before attachment to the frame and always resaturated before start of use and kept clean and saturated during use. Burlap shall conform to AASHTO M 182, Class 3 or 4.

#### 1.10.7.2 Deep Texturing Equipment

NA

#### 1.10.8 Sawing Equipment

Equipment for sawing joints and for other similar sawing of concrete shall be standard diamond-type concrete saws mounted on a wheeled chassis which can be easily guided to follow the required alignment. Blades shall be diamond tipped. If demonstrated to operate properly, abrasive blades may be used. Wheel saws shall be saws with large diameter tungsten carbide tipped blades mounted on a heavy-duty chassis which will produce a saw kerf at least 40 mm wide. All saws shall be capable of sawing to the full depth required.

#### 1.10.9 Straightedge

The Contractor shall furnish and maintain at the job site, in good condition, one 4 m straightedge for each paving train for testing the hardened portland cement concrete surfaces. These straightedges shall be constructed of aluminum or magnesium alloy and shall have blades of box or box-girder cross section with flat bottom, adequately reinforced to insure rigidity and accuracy. Straightedges shall have handles for operation on the pavement.

#### 1.10.10 Profilograph

The Contractor shall furnish a 7.6 m profilograph for testing the finished pavement surface. The profilograph shall produce a record on tape of the results of testing the pavement surface and shall automatically mark the Profile Index of each section tested as well as indicate and measure each "must grind" point, all in accordance with CDT Test 526 and as required by paragraph Surface Smoothness.

## PART 2 PRODUCTS

### 2.1 CEMENTITIOUS MATERIALS

Cementitious materials shall be portland cement, or portland cement in combination with pozzolan and shall conform to appropriate specifications listed below. Temperature of cementitious materials as supplied to the project shall not exceed 65 degrees C.

#### 2.1.1 Portland Cement

Portland cement shall conform to ASTM C 150, Type I or II. The cement shall meet the requirements for low alkali and for false set contained therein. If the Contractor can satisfactorily demonstrate that the proposed composition of cement and aggregates to be used in the concrete mix is nonreactive when tested in accordance with ASTM C227, the low alkali requirement may be waived. Certified test results and supporting test data for determining non reactivity must be submitted for approval and no substitutions shall be permitted in the aggregates and cement used in the work without additional testing.

#### 2.1.2 Pozzolan (Fly Ash and Silica Fume)

##### 2.1.2.1 Fly Ash

Fly ash shall conform to ASTM C 618, Class C or F, with the optional requirements for multiple factor, drying shrinkage, and uniformity from Table 2A in ASTM C 618. Table 1A from ASTM C 618 requirement for maximum alkalis shall apply. Maximum loss of ignition shall not be over 4 percent. Fly ash shall be used only at a rate between 15 and 25 percent of the total cementitious material by mass.

#### 2.2 AGGREGATES

##### 2.2.1 Coarse Aggregate

Coarse aggregate shall have a satisfactory service record of at least 5 years successful service in three paving projects or, if a new source is used, shall meet the requirements when tested for resistance to freezing and thawing.

##### 2.2.1.1 Material Composition

Coarse aggregate shall consist of crushed or uncrushed gravel, crushed stone, or a combination thereof.

##### 2.2.1.2 Quality

Aggregates as delivered to the mixers shall consist of clean, hard, uncoated particles meeting the requirements of ASTM C 33 and other requirements specified herein. Coarse aggregate shall be washed. Washing shall be sufficient to remove dust and other coatings.

##### 2.2.1.3 Particle Shape Characteristics

Particles of the coarse aggregate shall be generally spherical or cubical in shape. The quantity of flat and elongated particles in any size group shall not exceed 20 percent by weight as determined by COE CRD-C 119. A flat particle is defined as one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3.

##### 2.2.1.4 Size and Grading

The nominal maximum size of the coarse aggregate shall be 19 mm. The grading of the coarse aggregate when tested in accordance with ASTM 136, shall conform to the following requirements as delivered to the mixer:

Sieve Size U.S. Standard Square Mesh(mm)	Cumulative Percentage by Weight Passing Individual Sieves
25.4mm (1-inch)	100
19mm (3/4 inch)	90-100
12.5mm (1/2 inch)	---
9.5mm (3/8 inch)	20-54
4.75mm (No. 4)	0-10
2.36mm (No. 8)	0-6

2.2.1.5 Deleterious Materials - Airfield Pavements

The amount of deleterious material in each sieve size of coarse aggregate shall not exceed the limits shown in Table 5 below, determined in accordance with the test methods shown.

TABLE 5  
LIMITS OF DELETERIOUS MATERIALS IN COARSE AGGREGATE  
FOR AIRFIELD PAVEMENTS  
Percentage by Mass

Materials	Percentage by Weight
Clay lumps and friable particles (ASTM C 142)	0.2
Shale (a) (ASTM C 295)	0.1
Material finer than 0.075 mm (No. 200 sieve) (b) (ASTM C 117)	0.5
Lightweight particles (c) (ASTM C 123)	0.2
Clay ironstone (d) (ASTM C 295)	0.1
Chert and cherty stone (less than 2.40 Mg/cubic meter density SSD (2.40 Sp. Gr.)) (e) (ASTM C 295)	<u>0.3</u>
Claystone, mudstone, and siltstone (f) (ASTM C 295)	0.1
Shaly and argillaceous limestone (g) (ASTM C 295)	0.2

TABLE 5  
LIMITS OF DELETERIOUS MATERIALS IN COARSE AGGREGATE  
FOR AIRFIELD PAVEMENTS  
Percentage by Mass

Materials	Percentage by Weight
Other soft particles COE CRD-C 130	1.0
Total of all deleterious substances exclusive of material finer than 0.075 mm (No. 200 sieve)	1.0
<p>a. Shale is defined as a fine-grained, thinly laminated or fissile sedimentary rock. It is commonly composed of clay or silt or both. It has been indurated by compaction or by cementation, but not so much as to have become slate.</p> <p>b. Limit for material finer than 0.075 mm (No. 200 sieve) will be increased to 1.5 percent for crushed aggregates if the fine material consists of crusher dust that is essentially free from clay or shale.</p> <p>c. The separation medium shall have a density of 2.0 Mg/cubic meter (Sp. Gr. of 2.0). This limit does not apply to coarse aggregate manufactured from blast-furnace slag unless contamination is evident.</p> <p>d. Clay ironstone is defined as an impure variety of iron carbonate, iron oxide, hydrous iron oxide, or combinations thereof, commonly mixed with clay, silt, or sand. It commonly occurs as dull, earthy particles, homogeneous concretionary masses, or hard-shell particles with soft interiors. Other names commonly used for clay ironstone are "chocolate bars" and limonite concretions.</p> <p>e. Chert is defined as a rock composed of quartz, chalcedony or opal, or any mixture of these forms of silica. It is variable in color. The texture is so fine that the individual mineral grains are too small to be distinguished by the unaided eye. Its hardness is such that it scratches glass but is not scratched by a knife blade. It may contain impurities such as clay, carbonates, iron oxides, and other minerals. Other names commonly applied to varieties of chert are: flint, jasper, agate, onyx, hornstone, porcellanite, novaculite, sard, carnelian, plasma, bloodstone, touchstone, chrysoprase, heliotrope, and petrified wood. Cherty stone is defined as any type of rock (generally limestone) that contains chert as lenses and nodules, or irregular masses partially or completely replacing the original stone.</p> <p>f. Claystone, mudstone, or siltstone, is defined as a massive fine-grained sedimentary rock that consists predominantly of indurated clay or silt without laminations or fissility. It may be indurated either by compaction or by cementation.</p>	

- g. Shaly limestone is defined as limestone in which shale occurs as one or more thin beds or laminae. These laminae may be regular or very irregular and may be spaced from a few inches down to minute fractions of an inch. Argillaceous limestone is defined as a limestone in which clay minerals occur disseminated in the stone in the amount of 10 to 50 percent by weight of the rock; when these make up from 50 to 90 percent, the rock is known as calcareous (or dolomitic) shale (or claystone, mudstone, or siltstone).

#### 2.2.1.6 Testing Sequence for Deleterious Material-Airfields

The size of the sample shall be at least 90 kg for the 19 to 37 mm size and 12 kg for the 4.75 to 19 mm coarse aggregate and 5 kg for the fine aggregate. The Contractor shall provide facilities for the ready procurement of representative test samples. Samples shall be taken and tested by and at the expense of the Contractor, using appropriate Corps of Engineers laboratory and ASTM test methods. Additional tests and analyses of aggregates at various stages in the processing and handling operations may be made by the Government at the discretion of the Contracting Officer.

Such Government testing will not relieve the Contractor of any of its testing responsibilities. The testing procedure on each sample of coarse aggregate for compliance with limits on deleterious materials shall be as follows:

Step 1: Test approximately one-fifth of sample for material finer than the 0.075 mm sieve.

Step 2: Wash off material finer than 0.075 mm sieve from the remainder of the sample and recombine the remainder with material retained on the 0.075 mm sieve from Step 1.

Step 3: Test remaining full sample for clay lumps and friable particles and remove.

Step 4: Test remaining full sample for lightweight particles and remove, and then for chert and/or cherty stone with SSD density of less than 2.40 Mg/cubic meter (Sp. Gr. 2.40) and remove.

Step 5: Test remaining sample for clay-ironstone, shale, claystone, mudstone, siltstone, shaly and/or argillaceous limestone, and remove.

Step 6: Test approximately one-fifth of remaining full sample for other soft particles.

Determination of deleterious materials listed in Steps 4 and 5 shall be performed by an individual specifically trained in petrographic identification. The individual selected to perform the identification of these deleterious materials shall be subject to approval and, at least 10 days before any individual is proposed to commence this type of work, the Contractor shall submit a written r, sum, of the individual's training and experience for approval by The Material Testing Center (MTC), U.S. Army Engineer Waterways Experiment Station (WES), ATTN: CEWES-GS, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199. The Contractor will not be entitled to any extension of time or additional payment due to any delays caused by the testing, evaluation, or personnel requirements.

#### 2.2.1.7 Resistance to Freezing and Thawing

Coarse aggregate not having a satisfactory demonstrable service record shall have a durability factor of 50 or more when subjected to freezing and thawing in concrete in accordance with COE CRD-C 114.

2.2.1.8 Soundness

When subjected to five cycles of soundness test in accordance with ASTM C 88, the loss in weight of coarse aggregate shall not exceed 18 percent when magnesium sulfate is used.

2.2.1.9 Resistance to Abrasion

Coarse aggregate shall not show more than 40 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131.

2.2.1.10 Deleterious Material-Road Pavements

The amount of deleterious material in each sieve size of coarse aggregate shall not exceed the limits in the following table when tested as indicated.

LIMITS OF DELETERIOUS MATERIALS IN COARSE  
AGGREGATE FOR ROAD PAVEMENTS  
Percentage by Mass

Clay lumps and friable particles (ASTM C 142)	2.0
Material finer than 0.075 mm (No. 200 sieve) (ASTM C 117)	1.0
Lightweight particles (ASTM C 123)	1.0
Other soft particles (ASTM C 330)	2.0

The total of all deleterious substances shall not exceed 5.0 percent of the mass of the aggregate. The percentage of material finer than the 0.075 mm sieve shall not be included in this total. The limit for material finer than the 0.075 mm sieve will be increased to 1.5 percent for crushed aggregates consisting of crusher dust that is essentially free from clay or shale. The separation medium for lightweight particles shall have a density of 2.0 Mg/cubic meter (Sp. Gr. 2.0). This limit does not apply to coarse aggregate manufactured from blast-furnace slag unless contamination is evident.

2.2.2 Fine Aggregate

2.2.2.1 Composition

Fine aggregate shall consist of natural sand, manufactured sand, or a combination of the two, and shall be composed of clean, hard, durable particles. Irrespective of the source from which it is obtained, all fine aggregate shall be composed of clean, hard, durable particles meeting the requirements of ASTM C 33. Each type of fine aggregate shall be stockpiled and batched separately. Any degree of contamination will be cause for the rejection of the entire stockpile.

2.2.2.2 Particle Shape

Particles of the fine aggregate shall be generally spherical or cubical in shape.

2.2.2.3 Grading

Grading of the fine aggregate, as delivered to the mixer, shall conform to the following requirements when tested in accordance with ASTM C 136.

Sieve Size U.S. Standard Square Mesh(mm)	Cumulative Percentage by Weight Passing Individual Sieves
9.5mm (3/8 inch)	100
4.75mm (No. 4)	94-100
2.36mm (No. 8)	80-90
1.18mm (No. 16)	60-80
600um (No. 30)	30-60
300um (No. 50)	10-30
150um (No. 100)	2-10

In addition, the fine aggregate, as delivered to the mixer, shall have a fineness modulus of not less than 2.50 nor more than 2.90. The grading of the fine aggregate also shall be controlled so that the fineness moduli of at least nine of every set of ten consecutive samples of the fine aggregate, as delivered to the mixer, will not vary more than 0.15 from the average fineness moduli of all samples previously taken. The fineness modulus shall be determined by COE CRD-C 104.

2.2.2.4 Deleterious Material

The amount of deleterious material in the fine aggregate shall not exceed the following limits:

Material	Percentage by Mass
Clay lumps and friable particles (ASTM C 142)	1.0
Material finer than 0.075 mm (No. 200 sieve) (ASTM C 117)	3.0
Lightweight particles (ASTM C 123 using a medium with a density of 2.0 Mg/cubic meter (Sp. Gr. of 2.0))	0.5
Lignite	0.1
Total light particles	0.25

The total of all deleterious materials shall not exceed 3.0 percent of the weight of the aggregate.

2.2.2.5 Organic Impurities

Fine aggregate shall be free from injurious amounts of organic impurities. Aggregates that produce a color darker than the standard when tested in accordance with ASTM C 40 will be rejected except as provided hereinafter. Fine aggregate failing in the test may be used provided that the discoloration is due principally to the presence of coal, lignite or similar discrete particles, and provided that the percentage of these materials is within the specified limits for deleterious materials. Fine aggregate failing in the test may be used provided that, when tested for mortar-making properties, in accordance with ASTM C 87 the mortar develops a compressive strength as 7 days and 28 days of not less than 95 percent of the compressive strength developed by a similar mortar made from another portion of the same fine aggregate that has been washed in a 3-percent solution of sodium hydroxide followed by thorough rinsing in water. The treatment with sodium hydroxide shall reduce the organic-matter content of the fine aggregate to such an extent that the washed sand, when tested for organic-matter content, will show a color lighter than standard.

#### 2.2.2.6 Resistance to Freezing and Thawing

Fine aggregate not having a satisfactory demonstrable service record shall have a durability factor of 50 or more when subjected to freezing and thawing in concrete in accordance with COE CRD-C 114.

### 2.3 CHEMICAL ADMIXTURES

#### 2.3.1 Air-Entraining Admixtures

The air-entraining admixture shall conform to ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions. The air-entraining admixture shall be in a solution of suitable concentration for field use.

#### 2.3.2 Accelerator

An accelerator shall be used only when specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES and shall not be used to reduce the amount of cementitious material used. Accelerator shall conform to ASTM C 494, Type C. Calcium chloride and admixtures containing calcium chloride shall not be used.

#### 2.3.3 Retarder

A retarding admixture shall meet the requirements of ASTM C 494, Type B. The use of the admixture is at the option of the Contractor, but shall not be used to reduce the amount of cementitious material.

#### 2.3.4 Water-Reducer

A water-reducing admixture shall meet the requirements of ASTM C 494, Type A or D. The admixture may be added to the concrete mixture only when its use is approved or directed, and only when it has been used in mixture proportioning studies to arrive at approved mixture proportions.

### 2.4 CURING MATERIALS

#### 2.4.1 Membrane Forming Curing Compound

Membrane forming curing compound shall be a white pigmented compound

conforming to COE CRD-C 300.

#### 2.4.2 Burlap

Burlap used for curing shall conform to AASHTO M 182, Class 3 or 4. Materials shall be new or shall be clean materials never used for anything other than curing concrete.

#### 2.4.3 Impervious Sheet Materials

Impervious sheet materials shall conform to ASTM C 171, type optional, except polyethylene sheet shall not be used.

### 2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

### 2.6 JOINT MATERIALS

#### 2.6.1 Expansion Joint Material

Expansion joint filler shall be a preformed material conforming to ASTM D 1751 or ASTM D 1752. Expansion joint filler shall be 20 mm thick.

#### 2.6.2 Slip Joint Material

Slip joint material shall be 6 mm thick expansion joint filler conforming to ASTM D 1751 or ASTM D 1752.

### 2.7 REINFORCING

All reinforcement shall be free from loose, flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete. Removal of thin powdery rust and tight rust is not required. However, reinforcing steel which is rusted to the extent that it does not conform to the required dimensions or mechanical properties shall not be used.

#### 2.7.1 Reinforcing Bars and Bar Mats

Reinforcing bars shall conform to ASTM A 615, ASTM A 616, or ASTM A 617. Bar mats shall conform to ASTM A 184. The bar members shall be billet steel.

#### 2.7.2 Welded Wire Fabric

Welded steel wire fabric shall conform to ASTM A 185.

#### 2.7.3 Deformed Wire Fabric

Welded deformed steel wire fabric shall conform to ASTM A 497.

#### 2.7.4 Steel Fiber Reinforcing

Minimum ultimate tensile strength of the fibers shall be 345 MPa. The maximum aspect ratio (length divided by diameter) shall not exceed 100. Fibers longer than 62 mm shall not be used without approval of the Contracting Officer. The fibers shall be deformed and shall be furnished

in small bundles adhered with water soluble glue. The fibers shall be clean and free of rust, oil, and deleterious materials.

## 2.8 DOWELS AND TIE BARS

### 2.8.1 Dowels

Dowels shall be single piece bars fabricated or cut to length at the shop or mill before delivery to the site. Dowels shall be free of loose, flaky rust and loose scale and shall be clean and straight. Dowels may be sheared to length provided that the deformation from true shape caused by shearing does not exceed 1 mm on the diameter of the dowel and does not extend more than 1 mm from the end of the dowel. Dowels shall be plain (non-deformed) steel bars conforming to ASTM A 615, Grade 40 or 60; ASTM A 616, Grade 50 or 60; or ASTM A 617, Grade 40 or 60; or shall be steel pipe conforming to ASTM A 53, extra strong, as indicated. If split dowels are proposed for use, a complete description of the materials and installation procedures shall be submitted for approval at least 15 days before start of construction.

### 2.8.2 Tie Bars

Tie bars shall be deformed steel bars conforming to ASTM A 615, ASTM A 616, or ASTM A 617, Grade 60 or higher, and of the sizes and dimensions indicated. Deformed rail steel bars and high-strength billet or axle steel bars, Grade 60 or higher, shall not be used for bars that are bent and straightened during construction.

## 2.9 EPOXY RESIN

All epoxy-resin materials shall be two-component materials conforming to the requirements of ASTM C 881, Class as appropriate for each application temperature to be encountered, except that in addition, the materials shall meet the following requirements:

- a. Material for use for embedding dowels and anchor bolts shall be Type IV, Grade 3.
- b. Material for use as patching materials for complete filling of spalls, wide cracks, and other voids and for use in preparing epoxy resin mortar shall be Type III, Grade as approved.
- c. Material for use for injecting cracks shall be Type IV, Grade 1.
- d. Material for bonding freshly mixed portland cement concrete or mortar or freshly mixed epoxy resin concrete or mortar to hardened concrete shall be Type V, Grade as approved.

## 2.10 SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES

### 2.10.1 Specified Flexural Strength

Specified flexural strength,  $R$ , for concrete is 4830 kPa (700 psi) at 90 beams fabricated and cured in accordance with ASTM C 192 or as determined by equivalent flexural strength for acceptance as specified in paragraph, Flexural Strength. Maximum allowable water-cementitious material ratio is 0.45. The water-cementitious material ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan by the mass equivalency method described in

ACI 211.1. The concrete shall be air-entrained with a total air content of 6 plus or minus 1.5 percentage points, at the point of placement. Air content shall be determined in accordance with ASTM C 231. The maximum allowable slump of the concrete at the point of placement shall be 50 mm for pavement constructed with fixed forms. For slipformed pavement, at the start of the project, the Contractor shall select a maximum allowable slump which will produce in-place pavement meeting the specified tolerances for control of edge slump.

#### 2.10.2 Concrete Temperature

The temperature of the concrete as delivered shall conform to the requirements of paragraphs, Paving in Hot Weather and Paving in Cold Weather. Temperature of concrete shall be determined in accordance with ASTM C 1064.

#### 2.10.3 Concrete Strength

The strength of the concrete will be considered acceptable when the moving average of every 5 sets of flexural strengths at 90 day age are above the Specified flexural strength and no individual set is more than 0.35 MPa, below the specified flexural strength.

### 2.11 MIXTURE PROPORTIONS BY CONTRACTOR

#### 2.11.1 Composition

Concrete shall be composed of cementitious material, water, fine and coarse aggregates, and admixtures. The cementitious material shall be portland cement, or only portland cement in combination with pozzolan. Pozzolan, if used, shall consist of not less than 15 percent of the cementitious material by mass and not more than 25 percent. The total cementitious material content shall be at least 375 kg/cubic meter (624 lbs/cu.yd. ). Admixtures shall consist of air entraining admixture and may also include, as approved retarder and water-reducing admixture. If water-reducer is used, it shall be used only at the dosage determined during mixture proportioning studies. High range water-reducing admixtures and admixtures to produce flowable concrete shall not be used.

#### 2.11.2 Concrete Proportioning Studies, Pavement Concrete

Trial design batches, mixture proportioning studies, and testing requirements shall be the responsibility of the Contractor. Mixture proportioning studies shall be performed by a commercial laboratory, inspected by the Government, and approved in writing. The laboratory performing the mixture proportioning shall conform with ASTM C 1077. Strength requirements during mixture proportioning studies shall be based on flexural strength as determined by test specimens fabricated in accordance with ASTM C 192 and tested in accordance with ASTM C 78. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use on the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, slumps, and air content suitable for the work shall be based on methodology described in ACI 211.1, modified as necessary to accommodate flexural strength.

##### 2.11.2.1 Water-Cement Ratio

At least three different water-cement ratios, which will produce a range of

strength encompassing that required on the project, shall be used. The maximum allowable water-cement ratio required in paragraph Maximum Water-Cement Ratio will be the equivalent water-cement ratio as determined by conversion from the mass ratio of water to cement plus pozzolan by the weight equivalency method as described in ACI 211.1. If pozzolan is used in the concrete mixture, the minimum pozzolan content shall be 15 percent by mass of the total cementitious material, and the maximum shall be 25 percent. Laboratory trial mixtures shall be proportioned for maximum permitted slump and air content.

#### 2.11.2.2 Trial Mixture Studies

Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any placing method proposed which requires special properties. The temperature of concrete in each trial batch shall be reported. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding. Concrete proportioning studies shall be performed using the following procedures:

#### 2.11.2.3 Mixture Proportioning for 90-day Flexural Strength

The following step by step procedure shall be followed:

- a. Fabricate all beams and cylinders for each mixture from the same batch or blend of batches. Fabricate and cure all beams and cylinders in accordance with ASTM C 192, using 152 x 152 mm beams and 152 x 305 mm cylinders.
- b. Test beams in accordance with ASTM C 78, cylinders in accordance with ASTM C 39.
- c. Fabricate and cure test beams from each mixture for 7, 14, 28 and 90-day flexural tests; 6 beams to be tested per age.
- d. Using the average strength for each w/c at each age, plot all results from each of the three mixtures on separate graphs for w/c versus:

7-day flexural strength  
 14-day flexural strength  
 28-day flexural strength  
 90-day flexural strength

- e. From these graphs select a w/c that will produce a mixture giving a 90-day flexural strength equal to the required strength determined in accordance with paragraph "Average Flexural Strength Required for Mixtures".
- f. Using the above selected w/c, select from the graphs the expected 7, 14, 28 and 90-day flexural strengths for the mixture.
- g. From the above expected strengths for the selected mixture determine the following Correlation Ratios:

- i. If there is a change in materials, additional mixture design studies shall be made using the new materials and new Correlation Ratios shall be determined.
- j. No concrete pavement shall be placed until the Contracting Officer has approved the Contractor's mixture proportions.

2.11.3 Average Flexural Strength Required for Mixtures

In order to ensure meeting, during production, the strength requirements specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES, the mixture proportions selected during mixture proportioning studies and used during construction shall produce a required average flexural strength exceeding the specified strength, R, by the amount indicated below. This required average flexural strength, Ra, will not be a required acceptance criteria during concrete production, but will be used for CQC operations as specified in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL. During production, the required Ra shall be adjusted (increased or decreased), as appropriate and as approved, based on the standard deviation of equivalent 90-day strengths being attained during paving.

2.11.3.1 From Previous Test Records

Where a concrete production facility has previous test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected, shall represent concrete produced to meet a specified flexural strength or strengths within 1 MPa of the 90-day flexural strength specified for the proposed work, and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two specimens made from the same sample of concrete and tested at 90 days. Required average flexural strength, Ra, used as the basis for selection of concrete proportions shall be the value from the equation that follows, using the standard deviation as determined above:

$$Ra = R + 1.34S$$

Where: S = standard deviation  
 R = specified flexural strength  
 Ra = required average flexural strength

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

MODIFICATION FACTOR  
NUMBER OF TESTS            FOR STANDARD DEVIATION

### 2.11.3.2 Without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, the required average strength,  $R_a$ , shall be determined by adding 15 percent to the specified flexural strength,  $R$ .

## PART 3 EXECUTION

### 3.1 PREPARATION FOR PAVING

Before commencing paving, the following shall be performed. Surfaces to receive concrete shall be prepared as specified below. If used, forms shall be in place, cleaned, coated, and adequately supported. Any reinforcing steel needed shall be at the paving site. All transporting and transfer equipment shall be ready for use, clean, and free of hardened concrete and foreign material. Equipment for spreading, consolidating, screeding, finishing, and texturing concrete shall be at the paving site, clean and in proper working order. All equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the paving site, in proper working condition, and in sufficient amount for the entire placement. When hot, windy conditions during paving appear probable, equipment and material shall be at the paving site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

### 3.2 CONDITIONING OF UNDERLYING MATERIAL

#### 3.2.1 General

Underlying material upon which concrete is to be placed shall be clean, damp, and free from debris, waste concrete or cement, frost, ice, and standing or running water. Prior to setting forms or placement of concrete, the underlying material shall be well drained and shall have been satisfactorily graded and uniformly compacted in accordance with the applicable Section of these specifications. The surface of the subgrade or base course shall be tested as to crown, elevation, and density in advance of setting forms or of concrete placement using slip-form techniques. High areas shall be trimmed to proper elevation. Low areas shall be filled and compacted to a condition similar to that of surrounding grade, or filled with concrete monolithically with the pavement. Where low areas are filled with concrete, the areas shall be marked, as approved, and cores for thickness determinations as required by paragraph, Flexural Strength and Thickness shall not be drilled in those areas. Any underlying material disturbed by construction operations shall be reworked and recompact to specified density immediately in front of the paver. If a slipform paver is permitted and is used, the same underlying material under the paving lane shall be continued beyond the edge of the lane a sufficient distance and shall be thoroughly compacted and true to grade to provide a suitable trackline for the slipform paver and firm support for the edge of the paving lane. Where an open-graded granular base is required under the concrete, the Contractor shall select paving equipment and procedures which will operate properly on the base course without causing displacement or other damage.

3.2.2 Traffic on Underlying Material

After the underlying material has been prepared for concrete placement, no equipment shall be permitted thereon. Subject to specific approval, crossing of the prepared subgrade or base course at specified intervals for construction purposes may be permitted, provided rutting or indentations do not occur; however, if traffic has been allowed to use the prepared subgrade or base course, the surface shall be reworked and reprepared to the satisfaction of the Contracting Officer before concrete is placed.

3.3 WEATHER LIMITATIONS

3.3.1 Placement and Protection During Inclement Weather

The Contractor shall not commence placing operations when heavy rain or other damaging weather conditions appear imminent. At all times when placing concrete, the Contractor shall maintain on-site sufficient waterproof cover and means to rapidly place it over all unhardened concrete or concrete that might be damaged by rain. Placement of concrete shall be suspended whenever rain or other damaging weather commences to damage the surface or texture of the placed unhardened concrete, washes cement out of the concrete, or changes the water content of the surface concrete. All unhardened concrete shall be immediately covered and protected from the rain or other damaging weather. Any pavement damaged by rain or other weather shall be completely removed and replaced at the Contractor's expense as specified in paragraph, Repair, Removal, Replacement of Slabs.

3.3.2 Paving in Hot Weather

When the ambient temperature during paving is expected to exceed 32 degrees C, the concrete shall be properly placed and finished in accordance with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064. Cooling of the mixing water or aggregates or placing in the cooler part of the day may be required to obtain an adequate placing temperature. An approved retarder may be used to facilitate placing and finishing. Steel forms and reinforcing shall be cooled as approved prior to concrete placement when steel temperatures are greater than 49 degrees C. Transporting and placing equipment shall be cooled or protected if necessary to maintain proper concrete-placing temperature. Concrete shall be placed continuously and rapidly at a rate of not less than 30 m of paving lane per hour. The finished surfaces of the newly laid pavement shall be kept damp by applying a fog spray (mist) with approved spraying equipment until the pavement is covered by the curing medium. If necessary, wind screens shall be provided to protect the concrete from an evaporation rate in excess of 1 kg/square meter per hour, as determined by method shown in Figure 2.1.5 of ACI 305R.

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature in Degrees C
Greater than 60	33
40-60	30
Less than 40	27

### 3.3.3 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, the Contractor shall develop and institute measures to prevent plastic shrinkage cracks from developing. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of ACI 305R. In addition to the protective measures specified in the previous paragraph, the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding, or wet covering. When such water treatment is stopped, curing procedures shall be immediately commenced. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

### 3.3.4 Paving in Cold Weather

Special protection measures, as submitted and approved, and as specified herein, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air at the placing site and the temperature of surfaces to receive concrete shall be not less 5 degrees C. However, placement may begin when both the ambient temperature and the temperature of the underlying material are at least 2 degrees C and rising. When the ambient temperature is less than 10 degrees C, the temperature of the concrete when placed shall be not less than 10 degrees C nor more than 25 degrees C. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, chemical admixture conforming to ASTM C 494 Type C or E may be used provided it contains no calcium chloride. Calcium chloride shall not be used at any time. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 10 degrees C for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period. Pavement damaged by freezing shall be completely removed and replaced at the Contractor's expense as specified in paragraph REPAIR, REMOVAL, REPLACEMENT OF SLABS.

## 3.4 CONCRETE PRODUCTION

Batching, mixing, and transporting equipment shall have a capacity sufficient to maintain a continuous, uniform forward movement of the paver of not less than 0.8 m per minute. Concrete shall be deposited in front of the paver within 45 minutes from the time cement has been charged into the mixing drum, except that if the ambient temperature is above 32 degrees C, the time shall be reduced to 30 minutes. No water shall be added to the concrete after it is batched except that, if truck mixers are permitted, water may be added at the paving site to adjust the slump as approved, provided the maximum allowable w/c is not exceeded. Such water shall be injected under pressure as described in subparagraph, Truck Mixers. Every load of concrete delivered to the paving site shall be accompanied by a batch ticket from the operator of the batching plant. Tickets shall be on approved forms and shall show at least the mass, or volume, of all ingredients in each batch delivered, the water meter and revolution meter reading on truck mixers and the time of day. Tickets

shall be delivered to the placing foreman who shall keep them on file and deliver them to the Government weekly.

#### 3.4.1 Batching and Mixing Concrete

The batching and mixing equipment and the operation thereof shall conform to the requirements of paragraph EQUIPMENT and as specified herein. All equipment shall be kept clean and in operable condition at all times. Scale pivots and bearings shall be kept clean and free of rust. Any equipment which fails to perform as specified shall immediately be removed from use until properly repaired and adjusted, or replaced.

#### 3.4.2 Transporting and Transfer - Spreading Operations

The transporting and transfer equipment and the operation thereof shall conform to the requirements of paragraph EQUIPMENT and as specified herein.

All equipment shall be kept clean and in operable condition at all times. Non-agitating equipment shall be used only on smooth roads and for haul time less than 15 the prepared and compacted underlying material in front of the paver-finisher. Equipment shall be allowed to operate on the underlying material only if approved in writing and only if no damage is done to the underlying material and its degree of compaction. Any disturbance to the underlying material that does occur shall be corrected, as approved, before the paver-finisher or the deposited concrete reaches the location of the disturbance and the equipment shall be replaced or procedures changed to prevent any future damage. An approved transfer spreader shall be used to transfer the concrete from hauling equipment outside the paving lane and to spread it evenly and strike it off to approximate grade in front of the paver-finisher. Concrete shall be deposited as close as possible to its final position in the paving lane. All equipment shall be operated to discharge and transfer concrete without segregation. In no case shall dumping of concrete in discrete piles be permitted. No transfer or spreading operation which requires the use of front-end loaders, dozers, or similar equipment to distribute the concrete will be permitted. All batching and mixing, transporting, transferring, paving, and finishing shall be properly coordinated and controlled such that the paver-finisher has a continuous forward movement at a reasonably uniform speed from beginning to end of each paving lane, except for inadvertent equipment breakdown. Failure to achieve this shall require the Contractor to halt operations, regroup, and modify operations to achieve this requirement.

### 3.5 PAVING

#### 3.5.1 General Requirements

The paving and finishing equipment and the operation thereof shall conform to the requirements of paragraph EQUIPMENT and as specified herein. All equipment shall be kept clean and properly operable at all times. Pavement shall be constructed with paving and finishing equipment utilizing rigid fixed forms or by use of slipform paving equipment. Paving and finishing equipment and procedures shall be capable of constructing paving lanes of the required width at a rate of at least 30 m of paving lane per hour on a routine basis. Paving equipment and its operation shall be controlled, and coordinated with all other operations, such that the paver-finisher has a continuous forward movement, at a reasonably uniform speed, from beginning to end of each paving lane, except for inadvertent equipment breakdown. Workmen with foreign material on their footwear or construction equipment that might deposit foreign material shall not be permitted to walk or

operate in the plastic concrete.

### 3.5.2 Consolidation

Concrete shall be consolidated with the specified type of lane-spanning, gang-mounted, mechanical, immersion type vibrating equipment mounted in front of the paver, supplemented, in rare instances as specified, by hand-operated vibrators. Gang-mounted vibrator spuds shall be spaced so as to thoroughly consolidate the entire paving lane, but not more than 750 mm spacing, and with the outside vibrators not more than 300 mm from the edge of the lane. The vibrators shall be inserted into the concrete to a depth that will provide the best full-depth consolidation but not closer to the underlying material than 50 mm. The vibrators or any tamping units in front of the paver shall be automatically controlled so that they shall be stopped immediately as forward motion ceases. Excessive vibration shall not be permitted. If the vibrators cause visible tracking in the paving lane, the paving operation shall be stopped and equipment and operations modified to prevent it. Concrete in small, odd-shaped slabs or in locations inaccessible to the gang-mounted vibration equipment shall be vibrated with an approved hand-operated immersion vibrator. Vibrators shall not be used to transport or spread the concrete. Hand-operated vibrators shall not be operated in the concrete at one location for more than 20 seconds. For each paving train, at least one additional vibrator spud, or sufficient parts for rapid replacement and repair of vibrators shall be maintained at the paving site at all times. Any evidence of inadequate consolidation (honeycomb along the edges, large air pockets, or any other evidence) shall require the immediate stopping of the paving operation and approved adjustment of the equipment or procedures.

### 3.5.3 Operation

When the paver approaches a header at the end of a paving lane, a sufficient amount of concrete shall be maintained ahead of the paver to provide a roll of concrete which will spill over the header. The amount of extra concrete shall be sufficient to prevent any slurry that is formed and carried along ahead of the paver from being deposited adjacent to the header. The spud vibrators in front of the paver shall be brought as close to the header as possible before they are lifted. Additional consolidation shall be provided adjacent to the headers by hand-manipulated vibrators. When the paver is operated between or adjacent to previously constructed pavement (fill-in lanes), provisions shall be made to prevent damage to the previously constructed pavement. Transversely oscillating screeds and extrusion plates shall overlap the existing pavement the minimum possible, but in no case more than 200 mm. These screeds or extrusion plates shall be electronically controlled from the previously placed pavement so as to prevent them from applying pressure to the existing pavement and to prevent abrasion of the pavement surface. The overlapping area of existing pavement surface shall at all times be kept completely free of any loose or bonded foreign material as the paver-finisher operates across it. When the paver travels on existing pavement, approved provisions shall be made to prevent damage to the existing pavement. Pavers using transversely oscillating screeds shall not be used to form fill-in lanes that have widths less than a full width for which the paver was designed or adjusted.

### 3.5.4 Required Results

The paver-finisher, and its gang-mounted vibrators, together with its operating procedures shall be adjusted and operated and coordinated with the concrete mixture being used to produce a thoroughly consolidated slab

throughout, true to line and grade within specified tolerances. The screed or the extrusion plate shall be properly adjusted to produce a pavement surface true to line and grade. Any necessary adjustment to compensate for surging behind the screed or for inadequate height of surface after paving shall be carefully made and checked frequently. The paver-finishing operation shall produce a surface finish free of irregularities, tears, voids of any kind, and any other discontinuities. It shall produce only a very minimum of paste at the surface; never more than 2.5 mm cover over the top layer of coarse aggregate. The paver-finisher shall make only one pass across the pavement; multiple passes will not be permitted. The equipment and its operation shall produce a finished surface requiring no hand finishing other than the use of cutting straightedges, except in very infrequent instances. If any equipment or operation fails to produce the above results, the paving shall be stopped, the equipment shall be replaced or properly adjusted, the operation shall be appropriately modified, or the mixture proportions modified, in order to produce the required results before recommencing paving. No water, other than true fog sprays (mist) as specified in paragraph, Prevention of Plastic Shrinkage Cracking, shall be applied to the concrete or the concrete surface during paving and finishing.

### 3.5.5 Fixed Form Paving

Paving equipment for fixed-form paving and the operation thereof shall conform to the requirements of paragraph EQUIPMENT, all requirements specified above under paragraph PAVING and as specified herein.

#### 3.5.5.1 Forms for Fixed-Form Paving

- a. Forms shall be steel, except that wood forms may be used for curves having a radius of 45 m or less, and for fillets. Forms shall be equal in depth to the edge thickness of the slab as shown on the drawings. Forms shall be in one piece for the full depth required, except as permitted below. Under no conditions shall forms be adjusted by filling or excavating under the forms to an elevation other than the bottom of the pavement slab. Where the project requires several different slab thicknesses, forms may be built up with metal or wood to provide an increase in depth of not more than 25 percent. The required form depth may be obtained by securely bolting or welding to the bottom of the form a tubular metal section of the proper thickness or by securely bolting wood planks to the bottom of the form. The tubular metal section or wood planks shall completely cover the underside of the base of the form and shall extend beyond the edge of the base a sufficient distance to provide the necessary stability. The base width of the one-piece form, or built-up form, shall be not less than eight-tenths of the vertical height of the form, except that forms 200 mm or less in vertical height shall have a base width not less than the vertical height of the form. Forms shall not be built-up by adding to the top. The top surface of each form section shall not vary more than 1.5 mm in 4 m from a true line. The face of the form shall not vary more than 5 mm in 4 m from a true plane. Forms with battered top surfaces or distorted faces or bases shall be removed from the project. Where keyway forms are required, they shall be rigidly attached to the main form so no displacement can take place. Metal keyway forms shall be tack-welded to steel forms. Keyway forms shall be so aligned that there is no variation over 6 mm either vertically or horizontally, when tested with a 4 m template after forms are set, including tests across form joints.

- b. Steel forms shall be furnished in sections not less than 3 m in length, except that on curves having a radius of 45 m or less, the length of the sections shall be 1.5 m unless the sections are flexible or curved to the proper radius. Each 3 m length of form shall be provided with at least three form braces and pin sockets so spaced that the form will be rigidly braced throughout its length. Lock joints between form sections shall be free from play or movement. Forms shall be free of warps, bends, or kinks.
- c. Wood forms for curves and fillets shall be made of well-seasoned, surfaced plank or plywood, straight, and free from warp or bend. Wood forms shall be adequate in strength and rigidly braced.
- d. The forms shall be set on firm material cut true to grade so that each form section when placed will be firmly in contact with the underlying layer for its entire length and base width. Underlying material shall be thoroughly compacted and trimmed to grade before forms are set in place. Setting forms on blocks or on built-up spots of underlying material will be not permitted under any condition. The form sections shall be staked into position and tightly locked together. The length of pins and quantity provided in each section shall be sufficient to hold the form at the correct line and grade. When tested with a straightedge, the top of the installed form shall conform to the requirements specified for the finished surface of the concrete, and the longitudinal axis of the upstanding leg shall not vary more than 6 mm from the straightedge. Conformity to the alignment and grade elevations shown on the drawings shall be checked and necessary corrections shall be made immediately prior to placing the concrete. Forms shall be set well in advance of concrete placement. The forms shall be cleaned and oiled each time before concrete is placed. No concrete shall be placed until setting of forms has been checked and approved by the CQC team.

#### 3.5.5.2 Form Removal

Forms shall remain in place at least 12 hours after the concrete has been placed. When conditions are such that the early strength gain of the concrete is delayed, the forms shall be left in place for a longer time, as directed. Forms shall be removed by procedures that do not injure the concrete. Bars or heavy metal tools shall not be used directly against the concrete in removing the forms. Any concrete found to be defective after form removal shall be repaired promptly, using procedures specified hereinafter or as directed.

#### 3.5.6 Slipform Paving

##### 3.5.6.1 General

Paving equipment for slipform paving and the operation thereof shall conform to the requirement of paragraph EQUIPMENT, all requirements specified above in subparagraphs, General, Consolidation, Operation, and Required Results, and as specified herein. The slipform paver shall shape the concrete to the specified and indicated cross section, meeting all tolerances, in one pass. The slipform paver shall finish the surface and edges so that only a very minimum isolated amount of hand finishing is required. If the paving operation does not meet the above requirements and

the specified tolerances, the operation shall be immediately stopped, and the Contractor shall regroup and replace or modify any equipment as necessary, modify paving procedures or modify the concrete mix, in order to resolve the problem. The slipform paver shall be automatically electronically controlled from a taut wire guideline for horizontal alignment and on both sides from a taut wire guideline for vertical alignment, except that electronic control from a ski operating on a previously constructed adjoining lane shall be used where applicable for either or both sides. Automatic, electronic controls for vertical alignment shall always be used on both sides of the lane. Control from a slope-adjustment control or control operating from the underlying material shall never be used. If approved by the Contracting Officer after a preconstruction demonstration, automatic laser controls may be used in lieu of or to supplement the taut wire guidelines. Side forms on slipform pavers shall be properly adjusted so that the finished edge of the paving lane meets all specified tolerances. Dowels in longitudinal construction joints shall be installed as specified below. The installation of these dowels by dowel inserters attached to the paver or by any other means of inserting the dowels into the plastic concrete shall not be permitted. If a keyway is required, a 0.45 to 0.55 mm thick metal keyway liner shall be installed as the keyway is extruded. The keyway liner shall be protected and shall remain in place and become part of the joint.

#### 3.5.6.2 Guideline for Slipform Paving

Guidelines shall be accurately and securely installed well in advance of concrete placement. Supports shall be provided at necessary intervals to eliminate all sag in the guideline when properly tightened. The guideline shall be high strength wire set with sufficient tension to remove all sag between supports. Supports shall be securely staked to the underlying material or other provisions made to ensure that the supports will not be displaced when the guideline is tightened or when the guideline or supports are accidentally touched by workmen or equipment during construction. The appliances for attaching the guideline to the supports shall be capable of easy adjustment in both the horizontal and vertical directions. When it is necessary to leave gaps in the guideline to permit equipment to use or cross underlying material, provisions shall be made for quickly and accurately replacing the guideline without any delay to the forward progress of the paver. Supports on either side of the gap shall be secured in such a manner as to avoid disturbing the remainder of the guideline when the portion across the gap is positioned and tightened. The guideline across the gap and adjacent to the gap for a distance of 60 m shall be checked for horizontal and vertical alignment after the guideline across the gap is tightened. Vertical and horizontal positioning of the guideline shall be such that the finished pavement shall conform to the alignment and grade elevations shown on the drawings within the specified tolerances for grade and smoothness. The specified tolerances are intended to cover only the normal deviations in the finished pavement that may occur under good supervision and do not apply to setting of the guideline. The guideline shall be set true to line and grade.

#### 3.5.6.3 Laser Controls

If the Contractor proposes to use any type of automatic laser controls, a detailed description of the system shall be submitted and a trial field demonstration shall be performed in the presence of the Contracting Officer at least one week prior to start of paving. Approval of the control system will be based on the results of the demonstration and on continuing satisfactory operation during paving.

### 3.5.7 Placing Reinforcing Steel

The type and amount of steel reinforcement shall be as shown on the drawings. For pavement thickness of 300 mm or more, the reinforcement steel shall be installed by the strike-off method wherein a layer of concrete is deposited on the underlying material, consolidated, and struck to the indicated elevation of the steel reinforcement. The reinforcement shall be laid upon the prestruck surface, and the remaining concrete shall then be placed and finished in the required manner. When placement of the second lift causes the steel to be displaced horizontally from its original position, provisions shall be made for increasing the thickness of the first lift and depressing the reinforcement into the unhardened concrete to the required elevation. The increase in thickness shall be only as necessary to permit correct horizontal alignment to be maintained. Any portions of the bottom layer of concrete that have been placed more than 30 minutes without being covered with the top layer shall be removed and replaced with newly mixed concrete without additional cost to the Government. For pavements less than 300 mm thick, the reinforcement shall be positioned on suitable chairs securely fastened to the subgrade prior to concrete placement. Concrete shall be vibrated after the steel has been placed. Regardless of placement procedure, the reinforcing steel shall be free from coatings which could impair bond between the steel and concrete, and laps in the reinforcement shall be as indicated. In lieu of the above, automatic reinforcement depressing attachments may be used to position the reinforcement, either bar mats or welded wire fabric, provided the entire operation is approved by the Contracting Officer. Regardless of the equipment or procedures used for installing reinforcement, the Contractor shall ensure that the entire depth of concrete is adequately consolidated.

### 3.5.8 Placing Dowels and Tie Bars

The method used in installing and holding dowels in position shall ensure that the error in alignment of any dowel from its required alignment after the pavement has been completed will not be greater than 1 mm per 100 mm. Except as otherwise specified below, location of dowels shall be within a horizontal tolerance of plus or minus 15 mm. The Contractor shall furnish an approved template for checking the alignment and position of the dowels.

The portion of each dowel intended to move within the concrete or expansion cap shall be painted with one coat of red lead or blue lead paint. When dry, the painted portion shall be wiped clean and coated with a thin, even film of lubricating oil before the concrete is placed. Pipe used as dowels shall be filled with a stiff sand-asphalt mixture or portland-cement mortar. Dowels and tie bars in joints shall be omitted when the center of the dowel or tie bar is located within a horizontal distance from an intersecting joint equal to or less than one-fourth of the slab thickness. Dowels shall be installed as specified in the following subparagraphs.

#### 3.5.8.1 Contraction Joints

Dowels and tie bars in longitudinal and transverse contraction joints within the paving lane shall be held securely in place, as indicated, by means of rigid metal frames or basket assemblies of an approved type. The assemblies shall consist of a framework of metal bars or wires arranged to provide rigid support for the dowels and the tie bars throughout the paving operation, with a minimum of four continuous bars or wires extending along the joint line. The dowels and tie bars shall be welded to the assembly or held firmly by mechanical locking arrangements that will prevent them from

rising, sliding out, or becoming distorted during paving operations. The basket assemblies shall be held securely in the proper location by means of suitable pins or anchors. At the Contractor's option, in lieu of the above, dowels and tie bars in contraction joints shall be installed near the front of the paver by insertion into the plastic concrete using approved equipment and procedures. Approval will be based on the results of a preconstruction demonstration which the Contractor shall conduct, showing that the dowels and tie bars are installed within specified tolerances.

#### 3.5.8.2 Construction Joints-Fixed Form Paving

Installation of dowels and tie bars shall be by the bonded-in-place method.

Installation by removing and replacing in preformed holes will not be permitted. Dowels and tie bars shall be prepared and placed across joints where indicated, correctly aligned, and securely held in the proper horizontal and vertical position during placing and finishing operations, by means of devices fastened to the forms. If split dowels are approved and used, the female portion of the split dowel shall be bonded in the initially placed pavement lane. The female portion of the split dowel shall be securely fastened to the pavement form and shall maintain the proper position and alignment of the dowel during concrete placement so that no mortar or other foreign material will enter the socket or coupling.

Before the split dowels are assembled, the external and internal threads shall be cleaned thoroughly to remove all cement, cement mortar, grit, dirt, and other foreign matter. In the final assembly, a minimum torque of 270 N-m shall be applied. The spacing of dowels and tie bars in construction joints shall be as indicated, except that, where the planned spacing cannot be maintained because of form length or interference with form braces, closer spacing with additional dowels or tie bars shall be used.

#### 3.5.8.3 Dowels Installed in Hardened Concrete

Dowels installed in hardened concrete, such as in longitudinal construction joints for slipform paving, in joints between new and existing pavement, and similar locations, shall be installed by bonding the dowels into holes drilled into the hardened concrete. The installation of dowels in longitudinal construction joints by dowel inserters attached to a slipform paver or by any other means of inserting the dowels into the plastic concrete shall not be permitted. Holes approximately 3 mm greater in diameter than the dowels shall be drilled into the hardened concrete with rotary core drills to receive the dowels. In lieu of rotary drills, the contractor may use percussion drills, provided that spalling at the collar of the hole does not occur. Regardless of the type of drill used, the drill shall be held rigidly in exact alignment by means of a stable jig or framework, solidly supported; gang drills meeting this are acceptable. Any damage to the concrete face during drilling shall be repaired as directed; continuing damage shall require modification of the equipment and operation. Dowels shall be bonded in the drilled holes using epoxy resin. Epoxy resin shall be injected at the back of the hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel shall not be permitted. The dowels shall be held in alignment at the collar of the hole, after insertion and before the grout hardens, by means of a suitable metal or plastic collar fitted around the dowel. The vertical alignment of the dowels shall be checked by placing a straightedge on the surface of the pavement over the top of the dowel and measuring the vertical distance between the straightedge and the beginning and ending

point of the exposed part of the dowel. The horizontal alignment shall be checked with a framing square. Dowels required to be installed in any joints between new and existing concrete shall be grouted in holes drilled in the existing concrete, all as specified above. Where tie bars are required in longitudinal construction joints of slipform pavement, bent tie bars shall be installed at the paver, in front of the transverse screed or extrusion plate. If tie bars are required, a standard keyway shall be constructed, and the bent tie bars shall be inserted into the plastic concrete through a 0.45 to 0.55 mm thick metal keyway liner. Tie bars shall not be installed in preformed holes. The keyway liner shall be protected and shall remain in place and become part of the joint. When bending tie bars, the radius of bend shall not be less than the minimum recommended for the particular grade of steel in the appropriate material standard. Before placement of the adjoining paving lane, the tie bars shall be straightened, using procedures which will not spall the concrete around the bar.

#### 3.5.8.4 Expansion Joints

Dowels in expansion joints shall be installed as shown using appropriate procedures specified above.

### 3.6 FINISHING

The finishing machine, or paver-finisher, shall meet all requirements specified in paragraph EQUIPMENT and herein. Finishing operations shall be a continuing part of placing operations starting immediately behind the strike-off of the paver and the machines shall be designed and operated to strike off, screed, and consolidate the concrete. Initial finishing shall be provided by the transverse screed or extrusion plate. The sequence of operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, texturing, and then edging of joints. Finishing shall be by the machine method. The hand method shall be used only infrequently and only on isolated areas of odd slab widths or shapes and in the event of a breakdown of the mechanical finishing equipment. [When approved, the hand finishing method may also be used for separate, isolated slabs during removal and replacement type repair operations.] Supplemental hand finishing for machine finished pavement shall be kept to an absolute minimum. Equipment to be used for supplemental hand finishing shall primarily be 3 to 4 m cutting straightedges; only very sparing use of bull floats shall be allowed. Any machine finishing operation which requires appreciable hand finishing, other than a moderate amount of straightedge finishing, shall be immediately stopped and proper adjustments made or the equipment replaced. Every effort shall be made to prevent bringing excess paste to the surface and any operations which produce more than 2.5 mm of paste (mortar, water, laitance, etc.) over the top layer of coarse aggregate shall be halted immediately and the equipment, mixture, or procedures modified as necessary. Compensation shall be made for surging behind the screeds or extrusion plate and settlement during hardening and care shall be taken to ensure that paving and finishing machines are properly adjusted so that the finished surface of the concrete (not just the cutting edges of the screeds) will be at the required line and grade. Surface checks shall be made regularly and paving operations immediately halted and adjustments made whenever compensation is inadequate. Screed and float adjustments of the machines shall be checked at the start of each day's paving operations and more often if required. Machines that cause frequent delays due to mechanical failure shall be replaced. When machines ride the edge of a previously constructed slab, the edge shall be kept clean and provision shall be made to protect the surface of the slab.

Clary screeds, "bridge deck" finishers, or other rotating pipe or tube type equipment will not be permitted. Finishing equipment and tools shall be maintained clean and in an approved condition. At no time shall water be added to the surface of the slab with the finishing equipment or tools, or in any other way, except for fog (mist) sprays specified to prevent plastic shrinkage cracking.

### 3.6.1 Longitudinal Floating

When the equipment contains a mechanical, longitudinal, oscillating float, the float shall be operated to smooth and finish the pavement immediately behind the transverse screed or extrusion plate. The float shall be operated maintaining contact with the surface at all times. Care shall be taken to prevent working paste to the surface in excess of the amount specified above.

### 3.6.2 Other Types of Finishing Equipment

Concrete finishing equipment of types other than those specified above may be used on a trial basis, when specifically approved, except that rotating pipe or tubes or bridge deck finishers will not be permitted. Approval will be given after demonstration on a test section prior to start of construction, and provided the Contracting Officer determines that the pavement produced is better than that produced by the specified equipment. The use of equipment that fails to produce finished concrete of the required quality, using concrete proportions and slump as specified, shall be discontinued, and the concrete shall be finished with specified equipment and in the manner specified above. Vibrating screeds or pans shall be used only for isolated slabs where hand finishing is permitted as specified, and only where specifically approved. Slipform paving equipment shall not be operated on fixed forms unless approved in writing prior to use.

### 3.6.3 Machine Finishing With Fixed Forms

The machine shall be designed to ride the forms and shall be operated to screed and consolidate the concrete. Machines that cause displacement of the forms shall be replaced. The machine shall make only one pass over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation shall be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

### 3.6.4 Machine Finishing With Slipform Pavers

The slipform paver shall be operated so that only a very minimum of additional finishing work is required to produce pavement surfaces and edges meeting the specified tolerances. Any equipment or procedure that fails to meet these specified requirements shall immediately be replaced or modified as necessary. A self-propelled nonrotating pipe float may be used if the Contractor desires while the concrete is still plastic, to remove minor irregularities and score marks. The pipe float shall be 150 to 250 mm in diameter and sufficiently long to span the full paving width when oriented at an angle of approximately 60 degrees with the center line. Only one pass of the pipe float shall be allowed. If there is sufficient concrete slurry or fluid paste on the surface that it runs over the edge of the pavement, the paving operation shall be immediately stopped and the equipment, mixture, or operation modified to prevent formation of such slurry. Any slurry which does run down the vertical edges shall be

immediately removed by hand, using stiff brushes or scrapers. No slurry, concrete or concrete mortar shall be used to build up along the edges of the pavement to compensate for excessive edge slump, either while the concrete is plastic or after it hardens. Slabs having areas of edge slump in excess of the specified tolerances shall be removed and replaced in accordance with paragraph, REPAIR, REMOVAL, REPLACEMENT OF SLABS; repair operations on such areas will not be permitted.

### 3.6.5 Surface Correction and Testing

After all other finishing is completed but while the concrete is still plastic, minor irregularities and score marks in the pavement surface shall be eliminated by means of cutting straightedges. Such straightedges shall be 4 m in length and shall be operated from the sides of the pavement and from bridges. A straightedge operated from the side of the pavement shall be equipped with a handle 1 m longer than one-half the width of the pavement. The surface shall then be tested for trueness with a straightedge held in successive positions parallel and at right angles to the center line of the pavement, and the whole area covered as necessary to detect variations. The straightedge shall be advanced along the pavement in successive stages of not more than one-half the length of the straightedge. Depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. Projections above the required elevation shall also be struck off and refinished. The straightedge testing and finishing shall continue until the entire surface of the concrete is free from observable departure from the straightedge and conforms to the surface requirements specified in paragraph ACCEPTABILITY OF WORK AND PAYMENT ADJUSTMENTS. Long-handled, flat bull floats shall be used very sparingly and only as necessary to correct minor, scattered surface defects. If frequent use of bull floats is necessary, the paving operation shall be stopped and the equipment, mixture or procedures adjusted to eliminate the surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Extreme care shall be taken to prevent overfinishing joints and edges. The surface finish of the pavement shall be produced essentially by the finishing machine and not by subsequent hand finishing operations. All hand finishing operations shall be subject to approval and shall be modified when directed. No water shall be added to the pavement surface during these operations.

### 3.6.6 Hand Finishing

Hand finishing operations shall be used only as specified above.

#### 3.6.6.1 Equipment

In addition to approved mechanical internal vibrators for consolidating the concrete, a strike-off and tamping template and a longitudinal float shall be provided for hand finishing. The template shall be at least 300 mm longer than the width of pavement being finished, of an approved design, and sufficiently rigid to retain its shape, and shall be constructed of metal or other suitable material shod with metal. The longitudinal float shall be at least 3 m long, of approved design, and rigid and substantially braced, and shall maintain a plane surface on the bottom of the base. Grate tampers (jitterbugs) shall not be used.

#### 3.6.6.2 Finishing and Floating

As soon as placed and vibrated, the concrete shall be struck off and

screeded to the crown and cross section and to such elevation above grade that when consolidated and finished, the surface of the pavement will be at the required elevation. The entire surface shall be tamped with the strike-off and tamping template, and the tamping operation continued until the required compaction and reduction of internal and surface voids are accomplished. Immediately following the final tamping of the surface, the pavement shall be floated longitudinally from bridges resting on the side forms and spanning but not touching the concrete. If necessary, additional concrete shall be placed and screeded, and the float operated until a satisfactory surface has been produced. The floating operation shall be advanced not more than half the length of the float and then continued over the new and previously floated surfaces. Long-handled, flat bull floats shall be used very sparingly and only as necessary to correct minor, scattered surface defects. If frequent use of bull floats is necessary, the operation shall be stopped and adjusted to eliminate the surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Extreme care shall be taken to prevent overfinishing joints and edges. No water shall be added to the pavement during finishing operations.

### 3.6.7 Texturing

Before the surface sheen has disappeared and before the concrete hardens, the surface of the pavement shall be given a texture as described herein. After curing is complete, all textured surfaces shall be thoroughly power broomed to remove all debris.

#### 3.6.7.1 Fabric Drag Surface Finish

Surface texture shall be applied by dragging the surface of the pavement, in the direction of the concrete placement, with an approved fabric drag. The drag shall be operated with the fabric moist, and the fabric shall be cleaned or changed as required to keep clean. The dragging shall be done so as to produce a uniform finished surface having a fine sandy texture without disfiguring marks.

### 3.6.8 Edging

After texturing has been completed, the edge of the slabs along the forms, along the edges of slipformed lanes, and at the joints shall be carefully finished with an edging tool to form a smooth rounded surface of 3 mm radius. Tool marks shall be eliminated, and the edges shall be smooth and true to line. No water shall be added to the surface during edging. Extreme care shall be taken to prevent overworking the concrete.

### 3.6.9 Outlets in Pavement

Recesses for the tie-down anchors, lighting fixtures, and other outlets in the pavement shall be constructed to conform to the details and dimensions shown. The concrete in these areas shall be carefully finished to provide a surface of the same texture as the surrounding area that will be within the requirements for plan grade and surface smoothness.

## 3.7 CURING

### 3.7.1 General

Concrete shall be continuously protected against loss of moisture and rapid temperature changes for at least 7 days from the completion of finishing

operations. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Sufficient sheet material to protect unhardened concrete from rain shall be at the paver at all times. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period. If any selected method of curing does not afford the proper curing and protection against concrete cracking, the damaged pavement shall be removed and replaced, and another method of curing shall be employed as directed. Curing shall be accomplished by one of the following methods.

### 3.7.2 Membrane Curing

A uniform coating of white-pigmented, membrane-forming, curing compound shall be applied to the entire exposed surface of the concrete as soon as the free water has disappeared from the surface after finishing. If evaporation is high and no moisture is present on the surface even though bleeding has not stopped, fog sprays shall be used to keep the surface moist until setting of the cement occurs and bleeding is complete. Curing compound shall then be immediately applied. Along the formed edge faces, it shall be applied immediately after the forms are removed. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water, and the curing compound applied as soon as the free water disappears. The curing compound shall be applied to the finished surfaces by means of an approved automatic spraying machine. The spraying machine shall be self-propelled and shall span the newly paved lane. The machine shall have one or more spraying nozzles that can be controlled and operated to completely and uniformly cover the pavement surface with the required amount of curing compound. The curing compound in the drum used for the spraying operation shall be thoroughly and continuously agitated mechanically throughout the full depth of the drum during the application. Air agitation may be used only to supplement mechanical agitation. Spraying pressure shall be sufficient to produce a fine spray as necessary to cover the surface thoroughly and completely with a uniform film. Spray equipment shall be kept clean and properly maintained and the spray nozzle or nozzles shall have adequate wind shields. The curing compound shall be applied with an overlapping coverage that will give a two-coat application at a coverage of not more than 10 square meters per L for each coat. A one-coat application may be applied provided a uniform application is obtained and coverage does not exceed more than 5 square meters per L. The application of curing compound by hand-operated, mechanical powered pressure sprayers will be permitted only on odd widths or shapes of slabs where indicated and on concrete surfaces exposed by the removal of forms. When the application is made by hand-operated sprayers, the second coat shall be applied in a direction approximately at right angles to the direction of the first coat. The compound shall form a uniform, continuous, cohesive film that will not check, crack, or peel and that will be free from pinholes and other discontinuities. If pinholes, abrasions, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be immediately resprayed. The surfaces adjacent to joint sawcuts shall be cleaned and resprayed with curing compound immediately after cutting. Approved standby facilities for curing concrete pavement shall be provided at an accessible location at the

job site for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

### 3.8 JOINTS

#### 3.8.1 General

Joints shall conform to the details indicated and shall be perpendicular to the finished grade of the pavement. All joints shall be straight and continuous from edge to edge or end to end of the pavement with no abrupt offset and no gradual deviation greater than 12 mm. Before commencing construction, the Contractor shall submit for approval a control plan and equipment to be used for ensuring that all joints are straight from edge to edge of the pavement within the above tolerances. Where any joint fails to meet these tolerances, the slabs adjacent to the joint shall be removed and replaced at no additional cost to the Government. No change from the jointing pattern shown on the drawings shall be made without written approval of the Contracting Officer. Sealing of joints shall be in accordance with Section 02769 FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS.

#### 3.8.2 Longitudinal Construction Joints

Longitudinal construction joints between paving lanes shall be located as indicated. Dowels or keys or tie bars shall be installed in the longitudinal construction joints, or the edges shall be thickened as indicated. Dowels and Tie bars shall be installed in conformance with paragraph, Placing Dowels and Tie Bars. When the concrete is placed using stationary forms, metal keyway forms securely fastened to the concrete form shall be used to form a keyway in the plastic concrete. When the concrete is placed using slipform pavers, a keyway shall be formed in the plastic concrete by means of metal forms permanently attached to the side forms or by means of preformed metal keyway liners, which are inserted during the slipform operations and may be left in place. The dimensions of the keyway forms shall not vary more than plus or minus 3 mm from the dimensions indicated and shall not deviate more than plus or minus 6 mm from the mid-depth of the pavement. There shall be no abrupt offset either horizontally or vertically in the completed keyway. If any length of completed keyway of 1.5 m or more fails to meet the above tolerances, dowels shall be installed in that part of the joint by drilling holes in the hardened concrete and grouting the dowels in place with epoxy resins using approved materials and procedures. After the end of the curing period, longitudinal construction joints shall be sawed to provide a groove at the top for sealant conforming to the details and dimensions indicated.

#### 3.8.3 Transverse Construction Joints

Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for 30 minutes or longer. When concrete placement cannot be continued, the transverse construction joint shall be installed at a planned transverse joint, if possible. Transverse construction joints shall be constructed by utilizing headers and the very minimum amount of hand placement and finishing techniques. Pavement shall

be constructed with the paver as close to the header as possible, and the paver shall be run out completely past the header. Transverse construction joints installed at a planned transverse joint shall be constructed as shown or, if not shown otherwise, shall be dowelled. Those not at a planned transverse joint shall be constructed with tie bars and shall not be sawed or sealed.

#### 3.8.4 Expansion Joints

Expansion joints shall be formed where indicated, and about any structures and features that project through or into the pavement, using joint filler of the type, thickness, and width indicated, and shall be installed to form a complete, uniform separation between the structure and the pavement. The filler shall be attached to the original concrete placement with adhesive or other fasteners and shall extend the full slab depth. Adjacent sections of filler shall be fitted tightly together, and the filler shall extend across the full width of the paving lane or other complete distance in order to prevent entrance of concrete into the expansion space. Edges of the concrete at the joint face shall be finished with an edger with a radius of 3 mm. The joint filler strips shall be installed 20 mm below the pavement surface with a slightly tapered, dressed-and-oiled wood strip or other approved material temporarily secured to the top of the filler to form a recess to be filled with joint sealant. The wood strip shall be removed soon after the concrete has set and the reservoir temporarily filled with an approved material to protect the reservoir until the joint sealer is installed. Expansion joints shall be constructed with thickened edges for load transfer.

#### 3.8.5 Slip Joints

Slip joints shall be installed where indicated using the specified materials. Preformed joint filler material shall be attached to the face of the original concrete placement with adhesive or other fasteners. Bituminous material shall be applied to cover the entire surface of the face of the original concrete placement to a depth of 6 mm plus or minus 1.5 mm. Only a material which will remain in place on the vertical surface shall be used. In each case a 20 mm deep reservoir for joint sealant shall be constructed at the top of the joint. Edges of the joint face shall be finished with an edger with a radius of 3 mm.

#### 3.8.6 Contraction Joints

Transverse and longitudinal contraction joints shall be of the weakened-plane or dummy type and shall be constructed as indicated. Longitudinal contraction joints shall be constructed by sawing a groove in the hardened concrete with a power-driven saw in conformance with requirements for sawed joints, unless otherwise approved in writing. Transverse contraction joints shall be constructed in conformance with requirements for sawed joints.

##### 3.8.6.1 Sawed Joints

Sawed contraction joints shall be constructed by sawing an initial groove in the concrete with a 3 mm blade to the indicated depth. During sawing of joints, and again 24 hours later, the CQC team shall inspect all exposed lane edges for development of cracks below the saw cut, and shall immediately report results to the Contracting Officer. If the Contracting Officer determines that there are more uncracked joints than desired, the Contractor will be directed to saw succeeding joints 25 percent deeper than

originally indicated at no additional cost to the Government. After expiration of the curing period, the upper portion of the groove shall be widened by sawing to the width and depth indicated for the joint sealer. The time of initial sawing shall vary depending on existing and anticipated weather conditions and shall be such as to prevent uncontrolled cracking of the pavement. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping, spalling, or tearing. The sawed faces of joints will be inspected for undercutting or washing of the concrete due to the early sawing, and sawing shall be delayed if undercutting is sufficiently deep to cause structural weakness or excessive roughness in the joint. The sawing operation shall be carried on as required during both day and night regardless of weather conditions. The joints shall be sawed at the required spacing consecutively in the sequence of the concrete placement. A chalk line or other suitable guide shall be used to mark the alinement of the joint. Before sawing a joint, the concrete shall be examined closely for cracks, and the joint shall not be sawed if a crack has occurred near the planned joint location. Sawing shall be discontinued when a crack develops ahead of the saw cut. Workmen and inspectors shall wear clean, rubber-soled footwear, and the number of persons walking on the pavement shall be limited to those actually performing the sawing operation. Immediately after the joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly flushed with water until all waste from sawing is removed from the joint. The surface shall be resprayed with curing compound as soon as free water disappears. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, but that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed with cord, backer rod, or other approved material before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period and shall prevent infiltration of foreign material until removed immediately before sawing joint sealant reservoir. The sawing equipment shall be adequate in the number of units and the power to complete the sawing at the required rate. An ample supply of saw blades shall be available on the job before concrete placement is started and at all times during sawing. At least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operation.

#### 3.8.7 Thickened Edge Joints

Thickened edge joints shall be constructed as indicated on the drawings. Underlying material in the transition area shall be graded as shown and shall meet the requirements for smoothness and compaction specified for all other areas of the underlying material.

#### 3.8.8 Special Joints

"Special joints" (undercut joints) shall be constructed adjacent to existing pavement as indicated. The concrete under the edge of the existing pavement and the concrete below the normal level of the bottom of the new pavement shall be placed as a separate operation in front of the paving train. The concrete shall be worked under the edge of the existing pavement to completely fill the void and shall be thoroughly consolidated by the use of hand-held vibrators. Timing shall be such that this concrete is still workable when the paving train goes across it. In no case shall this concrete be placed as part of the operation of the paving equipment.

### 3.8.9 Sealing Joints

Joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit. Joints shall be sealed as specified in Section 02760 FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS.

## 3.9 REPAIR, REMOVAL, REPLACEMENT OF SLABS

### 3.9.1 General

New pavement slabs that are broken or contain cracks shall be removed and replaced or repaired, as specified hereinafter at no cost to the Government. Spalls along joints shall be repaired as specified. Where removal of partial slabs is permitted, as specified, removal and replacement shall be full depth, shall be full width of the paving lane, and the limit of removal shall be normal to the paving lane and not less than 3 m from each original transverse joint (i.e., removal portion shall be at least 3 m longitudinally, and portion to remain in place shall be at least 3 m 10 feet longitudinally; thus, if original slab length is less than 6 m, the entire slab shall be removed). The Contracting Officer will determine whether cracks extend full depth of the pavement and may require cores to be drilled on the crack to determine depth of cracking. Such cores shall be at least 150 mm diameter, shall be drilled by the Contractor and shall be filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with epoxy resin, using approved procedures. Drilling of cores and refilling holes shall be at no expense to the Government. All epoxy resin used in this work shall conform to paragraph EPOXY RESIN, Type and Grade as specified.

### 3.9.2 Slabs with Cracks Thru Interior Areas

Interior area is defined as that area more than 600 mm from either adjacent original transverse joint. Slabs with any cracks that extend into the interior area, regardless of direction, shall be treated by one of the following procedures.

#### 3.9.2.1 Cracks That Do Not Extend Full Depth of Slab

These cracks, and similar cracks within the areas 600 mm each side of transverse joints, shall be cleaned and then pressure injected with epoxy resin, Type IV, Grade 1, using procedures as approved. The procedure shall not widen the crack during epoxy resin injection. All epoxy resin injection shall take place in the presence of a representative of the Contracting Officer.

#### 3.9.2.2 Cracks That Extend Full Depth of Slab

Where there is any full depth crack at any place within the interior area, the full slab shall be removed. However, if the cracked area all lies within 3 m of one original transverse joint, only a partial slab need be removed provided all criteria specified above for distance from each original transverse joint is met.

### 3.9.3 Cracks close to and Parallel to Transverse Joints

All cracks essentially parallel to original transverse joints, extending full depth of the slab, and lying wholly within 600 mm either side of the joint shall be treated as specified hereinafter. Any crack extending more

than 600 mm from the transverse joint shall be treated as specified above for Slabs With Cracks Through Interior Areas. Any cracks which do not extend full depth of the slab shall be treated as specified above in subparagraph, Cracks That Do Not Extend Full Depth Of Slab, and the original transverse joint constructed as originally designed.

#### 3.9.3.1 Full Depth Cracks Present, Original Joint Not Opened

When the original transverse joint has not opened, the crack shall be routed and sealed, and the original transverse joint filled with epoxy resin. The crack shall be routed with an easily guided, wheel mounted, vertical shaft, powered rotary router designed so the routing spindle will caster as it moves along the crack. The reservoir for joint sealant in the crack shall be formed by routing to a depth of 19 mm, plus or minus 1.5 mm, and to a width of 16 mm, plus or minus 3 mm. Any equipment or procedure which causes raveling or spalling along the crack shall be modified or replaced to prevent such raveling or spalling. The joint sealant shall be a liquid sealant as specified for rigid pavement joints. Installation of joint seal shall be as specified for sealing joints or as directed. The uncracked transverse joint shall be filled with epoxy resin. If the joint sealant reservoir has been sawed out, the reservoir and as much of the lower saw cut as possible shall be filled with epoxy resin, Type IV, Grade 2, thoroughly tooled into the void using approved procedures. If only the original narrow saw cut has been made, it shall be cleaned and pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures. If filler material (joint insert) has been used to form a weakened plane in the transverse joint, it shall be completely sawed out and the saw cut pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures. Where a parallel crack goes part way across the paving lane and then intersects and follows the original transverse joint which is cracked only for the remainder of the width, it shall be treated as follows: The area with the separate crack shall be treated as specified above for a parallel crack, and the cracked original joint shall be prepared and sealed as originally designed.

#### 3.9.3.2 Full Depth Cracks, Original Joint Also Cracked

At a transverse joint, if there is any place in the lane width where a parallel crack and a cracked portion of the original joint overlap, a section of the slab containing the crack shall be removed and replaced for the full lane width and at least 3 m long. If this partial slab removal places the limit of removal less than 3 m from the next transverse joint, the entire slab shall be removed. If the parallel crack crosses the transverse joint line, a similar area shall be removed and replaced in both slabs.

#### 3.9.4 Removal and Replacement of Full Slabs

Where it is necessary to remove full slabs, unless there are keys or dowels present, all edges of the slab shall be cut full depth with a concrete saw. All saw cuts shall be perpendicular to the slab surface. If keys, dowels, or tie bars are present along any edges, these edges shall be sawed full depth 150 mm from the edge if only keys are present, or just beyond the end of dowels or tie bars if they are present. These joints shall then be carefully sawed on the joint line to within 25 mm of the depth of the dowel or key. The main slab shall be further divided by sawing full depth, at appropriate locations, and each piece lifted out and removed. Suitable equipment shall be used to provide a truly vertical lift, and approved safe lifting devices used for attachment to the slabs. The narrow strips along

keyed or doweled edges shall be carefully broken up and removed using light, hand-held jackhammers, 14 kg or less, or other approved similar equipment. Care shall be taken to prevent damage to the dowels, tie bars, or keys or to concrete to remain in place. The joint face below keys or dowels shall be suitably trimmed so that there is no abrupt offset in any direction greater than 12 mm and no gradual offset greater than 25 mm when tested in a horizontal direction with a straightedge. No mechanical impact breakers, other than the above hand-held equipment shall be used for any removal of slabs. If underbreak between 37 and 100 mm deep occurs at any point along any edge, the area shall be repaired as directed before replacing the removed slab. Procedures directed will be similar to those specified for surface spalls, modified as necessary. If underbreak over 100 mm deep occurs, the entire slab containing the underbreak shall be removed and replaced. Where there are no dowels, tie bars, or keys on an edge, or where they have been damaged, dowels of the size and spacing as specified for other joints in similar pavement shall be installed by epoxy grouting them into holes drilled into the existing concrete using procedures as specified in paragraph, Placing Dowels and Tie Bars. Original damaged dowels or tie bars shall be cut off flush with the joint face. Protruding portions of dowels shall be painted and lightly oiled. All four edges of the new slab shall thus contain dowels or original keys or original tie bars. Placement of concrete shall be as specified for original construction. Prior to placement of new concrete, the underlying material shall be recompacted and shaped as specified in the appropriate section of these specifications, and the surfaces of all four joint faces shall be cleaned of all loose material and contaminants and coated with a double application of membrane forming curing compound as bond breaker. Care shall be taken to prevent any curing compound from contacting dowels or tie bars. The resulting joints around the new slab shall be prepared and sealed as specified for original construction.

### 3.9.5 Removal and Replacement of Partial Slabs

Where the above criteria permits removal of partial slabs, removal and replacement operations shall be as specified for full slabs, except that the joint between the removed area and the partial slab to remain in place shall consist of a full depth saw cut across the full lane width and perpendicular to the centerline of the paving lane. Replacement operations shall be the same as specified above, except that, at the joint between the removed area and the partial slab to remain, deformed tie bars shall be epoxy resin grouted into holes drilled into the slab to remain in place. Size and spacing of the tie bars shall be as specified for dowels. Drilling of holes and installation of tie bars shall be as specified for dowels in paragraph, Placing Dowels and Tie Bars, except that no portion of the tie bars shall be painted or oiled. No curing compound shall be used on this joint face and, immediately before placing new concrete, the joint surface of the partial slab remaining in place shall be coated with epoxy resin, Type V, Grade 2.

### 3.9.6 Repairing Spalls Along Joints

Where directed, spalls along joints of new slabs, along edges of adjacent existing concrete, and along parallel cracks shall be repaired by first making a vertical saw cut at least 25 mm outside the spalled area and to a depth of at least 50 mm. Saw cuts shall be straight lines forming rectangular areas. The concrete between the saw cut and the joint, or crack, shall be chipped out to remove all unsound concrete and at least a depth of 12 mm of visually sound concrete. The cavity thus formed shall be thoroughly cleaned with high pressure water jets supplemented with

compressed air to remove all loose material. Immediately before filling the cavity, a prime coat shall be applied to the dry cleaned surface of all sides and bottom of the cavity, except any joint face. The prime coat shall be applied in a thin coating and scrubbed into the surface with a stiff-bristle brush. Prime coat for portland cement repairs shall be a neat cement grout and for epoxy resin repairs shall be epoxy resin, Type III, Grade 1. The cavity shall be filled with low slump portland cement concrete or mortar or with epoxy resin concrete or mortar. Portland cement concrete shall be used for larger spalls, those more than 0.009 cubic meter in size after removal operations; portland cement mortar shall be used for spalls between 0.00085 cubic meter and 0.009 cubic meter; and epoxy resin mortar or Type III, Grade 3 epoxy resin for those spalls less than 0.00085 cubic meter in size after removal operations. Portland cement concretes and mortars shall be very low slump mixtures, 12 mm slump or less, proportioned, mixed, placed, consolidated by tamping, and cured, all as directed. [If the materials and procedures are approved in writing, latex modified concrete mixtures may be used for repairing spalls less than 0.009 cubic meter in size.] Epoxy resin mortars shall be made with Type III, Grade 1, epoxy resin, using proportions and mixing and placing procedures as recommended by the manufacturer and approved by the Contracting Officer. The epoxy resin materials shall be placed in the cavity in layers not over 50 mm thick. The time interval between placement of additional layers shall be such that the temperature of the epoxy resin material does not exceed 60 degrees C at any time during hardening. Mechanical vibrators and hand tampers shall be used to consolidate the concrete or mortar. Any repair material on the surrounding surfaces of the existing concrete shall be removed before it hardens. Where the spalled area abuts a joint, an insert or other bond-breaking medium shall be used to prevent bond at the joint face. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints, or as required to be routed for cracks. The reservoir shall be thoroughly cleaned and then sealed with the sealer specified for the joints. If any spall penetrates half the depth of the slab or more, the entire slab, or 3 m portion thereof, shall be removed and replaced as previously specified. In lieu of sawing, spalls not adjacent to joints, and popouts, both less than 150 mm in maximum dimension, may be prepared by drilling a core 50 mm in diameter greater than the size of the defect, centered over the defect, and 50 mm deep or 12 mm into sound concrete, whichever is greater. The core hole shall be repaired as specified above for other spalls.

### 3.10 EXISTING CONCRETE PAVEMENT REMOVAL AND REPAIR

Existing concrete pavement shall be removed as indicated and as specified in Section 02050 DEMOLITION, modified, and expanded as specified herein. Repairs shall be made as indicated and as specified herein. All operations shall be carefully controlled to prevent damage to the concrete pavement and to the underlying material to remain in place. All saw cuts shall be made perpendicular to the slab surface, and forming rectangular areas.

#### 3.10.1 Removal of Existing Pavement Slab

When existing concrete pavement is to be removed and adjacent concrete is to be left in place, the joint between the removal area and adjoining pavement to stay in place, including dowels, tie bars or keys, shall first be cut full depth with a standard diamond-type concrete saw. Dowels of the size and spacing indicated shall be installed as shown on the drawings by epoxy resin bonding them in holes drilled in the joint face as specified in paragraph, Placing Dowels and Tie Bars.

### 3.10.2 Edge Repair

The edge of existing concrete pavement against which new pavement abuts shall be protected from damage at all times. Areas which are damaged during construction shall be repaired at no cost to the Government; repair of previously existing damage areas will be considered a subsidiary part of concrete pavement construction.

#### 3.10.2.1 Spall Repair

Spalls along joints and along cracks shall be repaired where indicated and where directed. Repair materials and procedures shall be as previously specified in subparagraph, Repairing Spalls Along Joints.

#### 3.10.2.2 Underbreak Repair

All underbreak shall be repaired. First, all delaminated and loose material shall be carefully removed. Next, the underlying material shall be recompacted, without addition of any new material. Finally, the void shall be completely hand-filled with paving concrete mixture, thoroughly consolidated. Care shall be taken to produce an even joint face from top to bottom. Prior to placing concrete, the underlying material shall be thoroughly moistened. After placement, the exposed surface shall be heavily coated with curing compound.

#### 3.10.2.3 Underlying Material

The underlying material adjacent to the edge of and under the existing pavement which is to remain in place shall be protected from damage or disturbance during removal operations and until placement of new concrete, and shall be shaped as shown on the drawings or as directed. Sufficient underlying material shall be kept in place outside the joint line to completely prevent disturbance of material under the pavement which is to remain in place. Any material under the portion of the concrete pavement to remain in place which is disturbed or loses its compaction shall be carefully removed and replaced with concrete as specified above under Underbreak Repair. The underlying material outside the joint line shall be thoroughly compacted and shall be moist when new concrete is placed.

### 3.11 PAVEMENT PROTECTION

The Contractor shall protect the pavement against all damage prior to final acceptance of the work by the Government. Aggregates and similar construction materials shall not be piled on airfield pavements. Traffic shall be excluded from the new pavement by erecting and maintaining barricades and signs until the concrete is at least 14 days old, or for a longer period if so directed. As a construction expedient in paving intermediate lanes between newly paved pilot lanes, operation of the hauling equipment will be permitted on the new pavement after the pavement has been cured for 7 days and the joints have been sealed or otherwise protected. Also, the subgrade planer, concrete paving and finishing machines, and similar equipment may be permitted to ride upon the edges of previously constructed slabs when the concrete has attained a minimum flexural strength of 2.8 MPa and approved means are furnished to prevent damage to the slab edge. All new and existing pavement carrying construction traffic or equipment shall be continuously kept completely clean, and spillage of concrete or other materials shall be cleaned up immediately upon occurrence. Special care shall be used where Contractor's traffic uses or crosses active airfield pavement. In these areas, if

necessary in order to accomplish this, full-time workmen with hand brooms shall be used at anytime there is traffic. Other existing pavements used by the Contractor shall be power broomed at least daily when traffic operates. For fill-in lanes, equipment shall be used that will not damage or spall the edges or joints of the previously constructed pavement.

### 3.12 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

#### 3.12.1 General

The Contractor shall perform the inspection and tests described below, and based upon the results of these inspections and tests, shall take the action required and submit reports as required. When, in the opinion of the Contracting Officer, the paving operation is out of control, concrete placement shall cease. The laboratory performing the tests shall be on-site and shall conform with ASTM C 1077. The individuals who sample and test concrete or the constituents of concrete as required in this specification shall have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I. The individuals who perform the inspection of concrete shall have demonstrated a knowledge and ability equivalent to the ACI minimum guidelines for certification of Concrete Construction Inspector, Level II. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per year thereafter for conformance with ASTM C 1077. This testing shall be performed by the Contractor regardless of any other testing performed by the Government, either for pay adjustment purposes or for any other reason.

#### 3.12.2 Testing and Inspection Requirements

##### 3.12.2.1 Fine Aggregate

- a. Grading. At least once during each shift when the concrete plant is operating, there shall be one sieve analysis and fineness modulus determination in accordance with ASTM C 136 and COE CRD-C 104 for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits.
- b. Corrective Action for Fine Aggregate Grading. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall be immediately reported to the Contracting Officer, paving shall be stopped, and immediate steps taken to correct the grading.

##### 3.12.2.2 Coarse Aggregate

- a. Grading. At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with ASTM C 136 for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control. However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples

of aggregate taken at the same locations shall show the results of the current test as well as the average results of the five most recent tests including the current test. The Contractor may adopt approved limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling.

- b. Corrective Action for Grading. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer, and steps taken to correct the grading. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be considered out of control and shall be reported to the Contracting Officer, paving shall be stopped, and immediate steps shall be taken to correct the grading.

#### 3.12.2.3 Quality of Aggregates

Thirty days prior to the start of concrete placement, the Contractor shall perform all tests specified for aggregate quality, including deleterious materials. In addition, after the start of paving, the Contractor shall perform similar tests for aggregate quality at least once every month, and when the source of aggregate or aggregate quality changes. Testing interval may be increased to three months when the previous two tests indicate the aggregate meets all quality requirements. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

#### 3.12.2.4 Scales, Batching and Recording

- a. Weighing Accuracy. The accuracy of the scales shall be checked by test weights prior to start of concrete operations and at least once every month for conformance with specified requirements. Such tests shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors.
- b. Batching and Recording Accuracy. Once a week the accuracy of each batching and recording device shall be checked during a weighing operation by noting and recording the required mass, recorded mass, and the actual mass batched. The Contractor shall test and ensure that the devices for dispensing admixtures are operating properly and accurately.
- c. Corrective Action. When either the weighing accuracy or batching accuracy does not comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made. Discrepancies in recording accuracies shall be corrected immediately.

#### 3.12.2.5 Batch-Plant Control

The measurement of all constituent materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate masses and amount of added water shall be adjusted as necessary to compensate for free moisture in the aggregates. The amount of air-entraining agent shall be adjusted to control air content within specified limits. A report shall be prepared

indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water masses per cubic meter, amount of water as free moisture in each size of aggregate, and the batch aggregate and water masses per cubic meter for each class of concrete batched during each day's plant operation.

#### 3.12.2.6 Concrete Mixture

- a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two other tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of paving. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Tests shall be made in accordance with ASTM C 231. Test results shall be plotted on control charts which are kept current and shall, at all times, be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. The result of each test, or average as noted in the previous sentence, shall be plotted on a separate control chart for each mixture on which an average line is set at the midpoint of the specified air content range from paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES. An upper warning limit and a lower warning limit line shall be set 1.0 percentage point above and below the average line, respectively. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between each two consecutive tests shall be plotted on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content shall be taken at the paving site. The Contractor shall deliver the concrete to the paving site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the paving site, correlation samples shall be taken at the paving site as required by the Contracting Officer, and the air content at the mixer controlled as directed.
- b. Air Content Corrective Action. Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, the admixture dispenser shall be recalibrated to insure that it is operating accurately and with good reproducibility. Whenever a point on either control chart (single test or result of two tests made concurrently, as specified above) reaches an action limit line, the air content shall be considered out of control and the paving operation shall immediately be halted until the air content is under control. Additional air

content tests shall be made when paving is restarted.

- c. Slump Testing. Slump tests shall be made when test specimens are fabricated. In addition, at least four other slump tests shall be made on randomly selected batches in accordance with ASTM C 143 for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond the upper action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control chart for slump and the chart for range, and for determining need for any remedial action. An upper warning limit shall be set at 12 mm below the maximum allowable slump on separate control charts for slump used for each type of mixture as specified in paragraph, SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES, and an upper action limit line shall be set at the maximum allowable slump, as specified in the same paragraph for fixed form paving or as selected by the Contractor at the start of the project for slipform paving. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 38 mm. Samples for slump shall be taken at the paving site. The Contractor is responsible for delivering the concrete to the paving site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the paving site, correlation samples shall be taken at the paving site as required by the Contracting Officer, and the slump at the mixer controlled as directed.
- d. Slump Corrective Action. Whenever points on the control charts for slump reach the upper warning limit, an approved adjustment shall immediately be made in the batch masses of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c specified, based on aggregates which are in a saturated surface dry condition. When a slump result (average of two tests made concurrently, as specified above) reaches the upper action limit, no further concrete shall be delivered to the paving site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch masses, produce a point on the control chart for range at or above the upper action limit, the paving operation shall immediately be halted, and the Contractor shall take approved steps to bring the slump under control. Additional slump tests shall be made as directed.
- e. Temperature. The temperature of the concrete shall be measured when flexural strength specimens are fabricated. Measurement shall be in accordance with ASTM C 1064. The temperature shall be reported along with the strength data.

### 3.12.2.7 Concrete Strength Testing for CQC

Contractor Quality Control operations for concrete strength shall consist of the following steps:

- a. Take samples for strength tests at the paving site. Fabricate and cure test cylinders in accordance with ASTM C 31; test them in accordance with ASTM C 39.
- b. Compare the equivalent 90-day flexural strength from the conversion to the Average Flexural Strength Required for Mixtures from paragraph of same title.
- c. If the equivalent average 90-day strength for the lot is below the Average Flexural Strength Required for Mixtures by 138 kPa flexural strength or more, at any time, adjust the mixture to increase the strength, as approved.
- d. If the equivalent average 90-day strength is above the Average Flexural Strength Required for Mixtures by 138 kPa flexural strength or more for 2 consecutive days, the Contractor will be permitted to adjust the mixture to decrease the strength, as approved.
- e. The Contractor's CQC testing agency shall maintain up-to-date control charts for strength

### 3.12.2.8 Inspection Before Placing

Underlying materials, construction joint faces, forms, reinforcing, dowels, and embedded items shall be inspected by the Contractor in sufficient time prior to each paving operation in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

### 3.12.2.9 Paving

- a. Paving Inspection. The placing foreman shall supervise all placing and paving operations, shall determine that the correct quality of concrete is placed in each location as shown and that finishing is performed as specified; shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume of concrete placed, and method of paving and any problems encountered.
- b. Placing and Paving Corrective Action. The paving foreman shall not permit batching and paving to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Paving shall not be continued if piles of concrete exist or if the concrete is inadequately consolidated or if surface finish is not satisfactory. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

### 3.12.2.10 Vibrators

- a. Vibrator Testing and Use. The frequency and amplitude of each

vibrator shall be determined in accordance with COE CRD-C 521 prior to initial use and at least once a month when paving is in progress. Additional tests shall be made as directed when a vibrator does not appear to be adequately consolidating the concrete. The frequency shall be determined while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. The amplitude shall be determined with the head vibrating in air. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head, and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing.

- b. **Vibrator Corrective Action.** Any vibrator not meeting the requirements of subparagraphs, Paver-Finisher and Consolidation, shall be immediately removed from service and repaired or replaced.

#### 3.12.2.11 Curing Inspection

- a. **Moist Curing Inspections.** At least twice each shift, and not less than four times per day (never more than 7 hours apart) on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.
- b. **Moist Curing Corrective Action.** When any inspection finds an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for the area shall be extended by 1 day.
- c. **Membrane Curing Inspection.** No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each day's operation, the quantity of compound used shall be determined by measurement of the container and the area of concrete surface covered; the Contractor shall then compute the rate of coverage in square meters per L and shall also note whether or not coverage is uniform. All this shall be reported daily.
- d. **Membrane Curing Corrective Action.** When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.
- e. **Sheet Curing Inspection.** At least once each shift and once per day on non-work days, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.
- f. **Sheet Curing Corrective Action.** When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by 1 day.

#### 3.12.2.12 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection

shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

#### 3.12.2.13 Mixer Uniformity

- a. Stationary Mixers. Prior to the start of concrete placing and once every 4 months when concrete is being placed, or once for every 38,000 cubic meters of concrete placed, whichever results in the longest time interval, uniformity of concrete mixing shall be determined in accordance with COE CRD-C 55. The original test shall be a Regular Test. After the mixing operation has been tested and approved, subsequent tests shall be Abbreviated Tests.
- b. Truck Mixers. Prior to the start of concrete placing and at least once every 4 months when concrete is being placed, uniformity of concrete mixing shall be determined in accordance with ASTM C 94. The truck mixers shall be selected randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.
- c. Mixer Uniformity Corrective Action. When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved. After adjustments have been made, another uniformity test shall be made.

#### 3.12.2.14 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

-- End of Section --

## SECTION 02760

FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS  
03/97

## 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 this text by the basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 509	(1994) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM D 789	(1994) Determination of Relative Viscosity, Melting Point, and Moisture Content of Polyamide (PA)
ASTM D 3405	(1994) Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements
ASTM D 3569	(1985; R 1991) Joint Sealant, Hot-Applied, Elastomeric, Jet-Fuel-Resistant-Type for Portland Cement Concrete Pavements

## CORPS OF ENGINEERS (COE)

COE CRD-C 525	(1989) Corps of Engineers Test Method for Evaluation of Hot-Applied Joint Sealants for Bubbling Due to Heating
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-06 Instructions

Manufacturer's Recommendations; FIO RE.

Where installation procedures, or any part thereof, are required to be in accordance with the manufacturer's recommendations, printed copies of these recommendations shall be submitted at least 30 days prior to use on the project. Installation of the material will not be allowed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

SD-07 Schedules

Construction Equipment List; FIO RE.

List of proposed equipment to be used in performance of construction work including descriptive data, 30 days prior to use on the project.

#### SD-13 Certificates

Sealant and Back-up Materials; GA RE.

Certified certificate(s) with test data showing compliance with the laboratory test requirements. No material will be allowed to be used until it has been approved.

### 1.3 Safety

Joint sealant shall not be placed within 8 meters of any liquid oxygen (LOX) equipment, LOX storage, or LOX piping. Joints in this area shall be thoroughly cleaned and left unsealed.

### 1.4 TEST REQUIREMENTS

The joint sealant and backup or separating material shall be tested for conformance with the referenced applicable material specification. Testing of the materials shall be performed in an approved independent laboratory and certified copies of the test reports shall be submitted and approved 60 days prior to the use of the materials at the job site. Samples will be retained by the Government for possible future testing should the materials appear defective during or after application. Conformance with the requirements of the laboratory tests specified will not constitute final acceptance of the materials. Final acceptance will be based on the performance of the in-place materials.

### 1.5 EQUIPMENT

Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and shall be maintained in satisfactory condition at all times.

#### 1.5.1 Joint Cleaning Equipment

##### 1.5.1.1 Tractor-Mounted Routing Tool

The routing tool used for removing old sealant from the joints shall be of such shape and dimensions and so mounted on the tractor that it will not damage the sides of the joints. The tool shall be designed so that it can be adjusted to remove the old material to varying depths as required. The use of V-shaped tools or rotary impact routing devices will not be permitted. Hand-operated spindle routing devices may be used to clean and enlarge random cracks.

##### 1.5.1.2 Concrete Saw

A self-propelled power saw with water-cooled diamond or abrasive saw blades will be provided for cutting joints to the depths and widths specified or for refacing joints or cleaning sawed joints where sandblasting does not provide a clean joint.

##### 1.5.1.3 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hose, and long-wearing venturi-type nozzle of proper size, shape and opening. The maximum nozzle opening should not exceed 6.4 mm (1/4 inch). The air compressor shall be portable and shall be capable of furnishing not less than 71 liters per second (150 cubic feet per minute) and maintaining a line pressure of not less than 621 kPa (90 psi) at the nozzle while in use. Compressor capability under job conditions must be demonstrated before approval. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint approximately 1 inch above the pavement surface. The height, angle of inclination and the size of the nozzle shall be adjusted as necessary to secure satisfactory results.

#### 1.5.1.4 Waterblasting Equipment

Waterblasting equipment shall include a trailer-mounted water tank, pumps, high-pressure hose, wand with safety release cutoff control, nozzle, and auxiliary water resupply equipment. The water tank and auxiliary resupply equipment shall be of sufficient capacity to permit continuous operations. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint approximately 25 mm above the pavement surface. The height, angle of inclination and the size of the nozzle shall be adjustable as necessary to obtain satisfactory results. A pressure gauge mounted at the pump shall show at all times the pressure in pounds per square inch at which the equipment is operating.

#### 1.5.1.5 Hand Tools

Hand tools may be used, when approved, for removing defective sealant from a crack and repairing or cleaning the crack faces.

### 1.5.2 Sealing Equipment

#### 1.5.2.1 Hot-Poured Sealing Equipment

The unit applicators used for heating and installing joint sealant materials shall be mobile and shall be equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the joint to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording type thermometer for indicating the temperature of the sealant. The applicator unit shall be designed so that the sealant will circulate through the delivery hose and return to the inner kettle when not in use.

### 1.6 TRIAL JOINT SEALANT INSTALLATION

Prior to the cleaning and sealing of the joints for the entire project, a test section of at least 60 m long shall be prepared using the specified materials and approved equipment, so as to demonstrate the proposed joint preparation and sealing of all types of joints in the project. Following the completion of the test section and before any other joint is sealed, the test section shall be inspected to determine that the materials and installation meet the requirements specified. If it is determined that the materials or installation do not meet the requirements, the materials shall be removed, and the joints shall be recleaned and resealed at no cost to the Government. When the test section meets the requirements, it may be

incorporated into the permanent work and paid for at the contract unit price per linear foot for sealing items scheduled. All other joints shall be prepared and sealed in the manner approved for sealing the test section.

1.7 DELIVERY AND STORAGE

Materials delivered to the job site shall be inspected for defects, unloaded, and stored with a minimum of handling to avoid damage. Storage facilities shall be provided by the Contractor at the job site for maintaining materials at the temperatures and conditions recommended by the manufacturer.

1.8 ENVIRONMENTAL CONDITIONS

The ambient air temperature and the pavement temperature within the joint wall shall be a minimum of 10 degrees C and rising at the time of application of the materials. Sealant shall not be applied if moisture is observed in the joint.

PART 2 PRODUCTS

2.1 SEALANTS

Materials for sealing cracks in the various paved areas indicated on the drawings shall be as follows:

Area	Sealing Material
Roadways	ASTM D 3405 and COE CRD-C 525
Aircraft Access Aprons	ASTM D 3569 and COE CRD-C 525

2.2 PRIMERS

Primers, when their use is recommended by the manufacturer of the sealant, shall be as recommended by the manufacturer of the sealant.

2.3 BACKUP MATERIALS

The backup material shall be a compressible, nonshrinking, nonstaining, nonabsorbing material and shall be nonreactive with the joint sealant. The material shall have a melting point at least 3 degrees C greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D 789. The material shall have a water absorption of not more than 5 percent of the sample weight when tested in accordance with ASTM C 509. The backup material shall be 25 plus or minus 5 percent larger in diameter than the nominal width of the crack.

2.4 BOND BREAKING TAPES

The bond breaking tape or separating material shall be a flexible, nonshrinkable, nonabsorbing, nonstaining, and nonreacting adhesive-backed tape. The material shall have a melting point at least 3 degrees C greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D 789. The bond breaker tape shall be approximately 3 mm wider than the nominal width of the joint and shall not bond to the joint sealant.

PART 3 EXECUTION

### 3.1 PREPARATION OF JOINTS

Immediately before the installation of the sealant, the joints shall be thoroughly cleaned to remove all laitance, curing compound, filler, protrusions of hardened concrete, and old sealant from the sides and upper edges of the joint space to be sealed.

#### 3.1.1 Existing Sealant Removal

The in-place sealant shall be cut loose from both joint faces and to the depth shown on the drawings, using the tractor-mounted routing equipment, concrete saw or waterblaster as specified in paragraph EQUIPMENT. Depth shall be sufficient to accommodate any separating or backup material that is required to maintain the depth of new sealant to be installed. Prior to further cleaning operations, all loose old sealant remaining in the joint opening shall be removed by blowing with compressed air. Hand tools may be required to remove sealant from random cracks. Chipping, spalling, or otherwise damaging the concrete will not be allowed.

#### 3.1.2 Sawing

##### 3.1.2.1 Facing of Joints

Facing of joints shall be accomplished using a concrete saw as specified in paragraph EQUIPMENT to remove all residual old sealant and a minimum of concrete from the joint face to provide exposure of newly cleaned concrete, and, if required, to enlarge the joint opening to the width and depth shown on the drawings. The blade shall be stiffened with a sufficient number of suitable dummy (used) blades or washers. Immediately following the sawing operation, the joint opening shall be thoroughly cleaned using a water jet to remove all saw cuttings and debris.

##### 3.1.2.2 Refacing of Random Cracks

Sawing of the cracks shall be accomplished using a power-driven concrete saw as specified in paragraph EQUIPMENT. The saw blade shall be 152 mm (6 inch) or less in diameter to enable the saw to follow the trace of the crack. The blade shall be stiffened as necessary with suitable dummy (or used) blades or washers. Immediately following the sawing operation, the crack opening shall be thoroughly cleaned using a water jet to remove all saw cuttings and debris.

#### 3.1.3 Sandblasting

The newly exposed concrete joint faces and the pavement surfaces extending a minimum of 13 mm from the joint edges shall be waterblasted clean. A multiple-pass technique shall be used until the surfaces are free of dust, dirt, curing compound, filler, old sealant residue, or any foreign debris that might prevent the bonding of the sealant to the concrete. After final cleaning and immediately prior to sealing, the joints shall be blown out with compressed air and left completely free of debris and water.

#### 3.1.4 Back-Up Material

When the joint opening is of a greater depth than indicated for the sealant depth, the lower portion of the joint opening shall be plugged or sealed off using a back-up material to prevent the entrance of the sealant below the specified depth. Care shall be taken to ensure that the backup

material is placed at the specified depth and is not stretched or twisted during installation.

#### 3.1.5 Bond Breaking Tape

Where inserts or filler materials contain bitumen, or the depth of the joint opening does not allow for the use of a backup material, a bond breaker separating tape will be inserted to prevent incompatibility with the filler materials and three-sided adhesion of the sealant. The tape shall be securely bonded to the bottom of the joint opening so it will not float up into the new sealant.

#### 3.1.6 Rate of Progress of Joint Preparation

The stages of joint preparation which include sandblasting, air pressure cleaning and placing of the back-up material shall be limited to only that lineal footage that can be sealed during the same day.

### 3.2 PREPARATION OF SEALANT

#### 3.2.1 Hot-Poured Sealants

Sealants conforming to ASTM D 3405 and ASTM D 3569 shall not be heated in excess of the safe heating temperature recommended by the manufacturer as shown on the sealant containers. Sealant that has been overheated or subjected to application temperatures for over 4 hours or that has remained in the applicator at the end of the day's operation shall be withdrawn and wasted.

#### 3.2.2 Single-Component, Cold-Applied Sealants

Sealant and containers shall be inspected prior to use. Any materials that contain water, hard caking of any separated constituents, nonreversible jell, or materials that are otherwise unsatisfactory shall be rejected. Settlement of constituents in a soft mass that can be readily and uniformly remixed in the field with simple tools will not be cause for rejection.

### 3.3 INSTALLATION OF SEALANT

#### 3.3.1 Time of Application

Joints shall be sealed immediately following final cleaning of the joint walls and following the placement of the separating or backup material. Open joints that cannot be sealed under the conditions specified, or when rain interrupts sealing operations shall be recleaned and allowed to dry prior to installing the sealant.

#### 3.3.2 Sealing Joints

Immediately preceding, but not more than 15 m ahead of the joint sealing operations, a final cleaning with compressed air shall be performed. The joints shall be filled from the bottom up to 6 mm plus or minus 1.5 mm below the pavement surface. Excess or spilled sealant shall be removed from the pavement by approved methods and shall be discarded. The sealant shall be installed in such a manner as to prevent the formation of voids and entrapped air. In no case shall gravity methods or pouring pots be used to install the sealant material. Traffic shall not be permitted over newly sealed pavement until authorized by the Contracting Officer. When a

primer is recommended by the manufacturer, it shall be applied evenly to the joint faces in accordance with the manufacturer's instructions. Joints shall be checked frequently to ensure that the newly installed sealant is cured to a tack-free condition within the time specified.

### 3.4 INSPECTION

#### 3.4.1 Joint Cleaning

Joints shall be inspected during the cleaning process to correct improper equipment and cleaning techniques that damage the concrete pavement in any manner. Cleaned joints shall be approved prior to installation of the separating or back-up material and joint sealant.

#### 3.4.2 Joint Sealant Application Equipment

The application equipment shall be inspected to ensure conformance to temperature requirements, proper proportioning and mixing (if two-component sealant) and proper installation. Evidences of bubbling, improper installation, failure to cure or set shall be cause to suspend operations until causes of the deficiencies are determined and corrected.

#### 3.4.3 Joint Sealant

The joint sealant shall be inspected for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Sealants exhibiting any of these deficiencies at any time prior to the final acceptance of the project shall be removed from the joint, wasted, and replaced as specified herein at no additional cost to the Government.

### 3.5 CLEAN-UP

Upon completion of the project, all unused materials shall be removed from the site and the pavement shall be left in a clean condition.

-- End of Section --

## SECTION 02763

PAVEMENT MARKINGS  
09/98

## 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 basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 247 (1981) Glass Beads Used in Traffic Paint

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 792 (1991) Density and Specific Gravity  
(Relative Density) of Plastics by  
Displacement

ASTM E 28 (1997) Softening Point of Resins by Ring  
and Ball Apparatus

FEDERAL SPECIFICATIONS (FS)

FS TT-B-1325 (Rev C; Notice 1) Beads (Glass Spheres)  
Retro-Reflective (Metric)

FS TT-P-1952 (Rev D) Paint, Traffic and Airfield  
Marking, Waterborne (Metric)

AIRFORCE PUBLICATIONS (AFI)

AFT 32-1042 (STANDARDS FOR MARKING AIRFIELDS)

1.2 [Enter Appropriate Subpart Title Here]

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. All submittals listed below shall be submitted at the same time. Failure to do so will cause the submittal to be rejected. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-01 Data

Equipment Lists; GA-RE.

Lists of proposed equipment, including descriptive data, and notifications of proposed Contractor actions as specified in this section. List of removal equipment shall include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation.

## SD-06 Instructions

Mixing, Thinning and Application; \_\_GA-RE\_\_.

Manufacturer's current printed product description and Material Safety Data Sheets (MSDS) for each type paint/color proposed for use.

## SD-08 Statements

Qualifications;GA-RE.

Document certifying that personnel are qualified for equipment operation and handling of chemicals.

## SD-09 Reports

Material Tests; \_\_GA-RE\_\_.

Certified copies of the test reports, prior to the use of the materials at the jobsite. Testing shall be performed in an approved independent laboratory.

## SD-13 Certificates

Volatile Organic Compound (VOC) Content; \_GA-RE\_\_\_\_\_.

Certificate stating that the proposed pavement marking paint meets the VOC regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located.

## 1.4 DELIVERY AND STORAGE

All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

## 1.5 EQUIPMENT

All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Equipment operating on roads and runways shall display low speed traffic markings and traffic warning lights.

## 1.5.1 Paint Application Equipment

The equipment to apply paint to pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The

machine shall have a speed during application not less than 8 kilometers per hour (5 mph), and shall be capable of applying the stripe widths indicated, at the paint coverage rate specified in paragraph APPLICATION, and of even uniform thickness with clear-cut edges. The equipment used to apply the paint binder to airfield pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with an arrangement of atomizing nozzles capable of applying a line width at any one time in multiples of 150 mm (6 inches), from 150 mm (6 inches) to 900 mm (36 inches). The paint applicator shall have paint reservoirs or tanks of sufficient capacity and suitable gauges to apply paint in accordance with requirements specified. Tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gauges in full view and reach of the operator. Paint strainers shall be installed in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

#### 1.5.2 Reflective Media Dispenser

The dispenser for applying the reflective media shall be attached to the paint dispenser and shall operate automatically and simultaneously with the applicator through the same control mechanism. The dispenser shall be capable of adjustment and designed to provide uniform flow of reflective media over the full length and width of the stripe at the rate of coverage specified in paragraph APPLICATION, at all operating speeds of the applicator to which it is attached.

#### 1.5.3 Surface Preparation Equipment

##### 1.5.3.1 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 70.8 liters per sec (150 cfm) of air at a pressure of not less than 620 kPa (90 psi) at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.

##### 1.5.3.2 Waterblast Equipment

The water pressure shall be specified at 17.9 MPa (2600 psi) at 60 degrees C (140 degrees F in order to adequately clean the surfaces to be marked.

#### 1.5.4 Marking Removal Equipment

Equipment shall be mounted on rubber tires and shall be capable of removing markings from the pavement without damaging the pavement surface or joint sealant. Waterblasting equipment shall be capable of producing an adjustable, pressurized stream of water. Sandblasting equipment shall include an air compressor, hoses, and nozzles. The compressor shall be equipped with traps to maintain the air free of oil and water.

##### 1.5.4.1 Shotblasting Equipment

Shotblasting equipment shall be capable of producing an adjustable depth of

removal of marking and pavement. Each unit shall be self-cleaning and self-contained, shall be able to confine dust and debris from the operation, and shall be capable of recycling the abrasive for reuse.

#### 1.5.4.2 Chemical Equipment

Chemical equipment shall be capable of application and removal of chemicals from the pavement surface, and shall leave only non-toxic biodegradable residue.

#### 1.5.5 Traffic Controls

Suitable warning signs shall be placed near the beginning of the worksite and well ahead of the worksite for alerting approaching traffic from both directions. Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers. Painting equipment shall be marked with large warning signs indicating slow-moving painting equipment in operation.

#### 1.6 HAND-OPERATED, PUSH-TYPE MACHINES

All machines, tools, and equipment used in performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces will be acceptable for marking small streets and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Sandblasting equipment shall be provided as required for cleaning surfaces to be painted. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

#### 1.7 WEATHER LIMITATIONS FOR REMOVAL

Pavement surface shall be free of snow, ice, or slush. Surface temperature shall be at least 5 degrees C and rising at the beginning of operations, except those involving shot or sand blasting. Operation shall cease during thunderstorms. Operation shall cease during rainfall, except for waterblasting and removal of previously applied chemicals. Waterblasting shall cease where surface water accumulation alters the effectiveness of material removal.

### PART 2 PRODUCTS

#### 2.1 PAINT

The paint shall be lead free, homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paints for airfields, roads, and streets shall conform to FS TT-P-1952. Select Type I, "Ten Minute No Pick-up Time" or Type II, "Fast Dry, High Humidity Formula." The color shall be as indicated for the parking lot and access road. Colors for the apron shall be the following color chips from FS 595: Yellow - 33538 and Black 37038. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

#### 2.2 REFLECTIVE MEDIA

Reflective media for airfields shall conform to FS TT-B-1325, Type I, Gradation A with refraction index of 1.5.

### 2.3 SAMPLING AND TESTING

Materials proposed for use shall be stored on the project site in sealed and labeled containers, or segregated at source of supply, sufficiently in advance of needs to allow 60 days for testing. Upon notification by the Contractor that the material is at the site or source of supply, a sample shall be taken by random selection from sealed containers by the Contractor in the presence of a representative of the Contracting Officer. Samples shall be clearly identified by designated name, specification number, batch number, manufacturer's formulation number, project contract number, intended use, and quantity involved. Testing shall be performed in an approved independent laboratory. If materials are approved based on reports furnished by the Contractor, samples will be retained by the Government for possible future testing should the material appear defective during or after application.

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

Surfaces to be marked shall be thoroughly cleaned before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion as directed. Areas of old pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be recleaned, when work has been stopped due to rain.

#### 3.1.1 Pretreatment for Early Painting

Where early painting is required on rigid pavements, a pretreatment with an aqueous solution containing 3 percent phosphoric acid and 2 percent zinc chloride shall be applied to prepared pavement areas prior to painting.

#### 3.1.2 Cleaning Existing Pavement Markings

In general, markings shall not be placed over existing pavement marking patterns. Existing pavement markings, which are in good condition but interfere or conflict with the newly applied marking patterns, shall be removed. Deteriorated or obscured markings that are not misleading or confusing or interfere with the adhesion of the new marking material do not require removal. Whenever grinding, scraping, sandblasting or other operations are performed the work must be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. When these operations are completed the pavement surface shall be blown off with compressed air to remove residue and debris resulting from the cleaning work.

### 3.1.3 Cleaning Concrete Curing Compounds

On new Portland cement concrete pavements, cleaning operations shall not begin until a minimum of 30 days after the placement of concrete. All new concrete pavements shall be cleaned by either sandblasting or water blasting. The extent of the blasting work shall be to clean and prepare the concrete surface as follows:

- a. There is no visible evidence of curing compound on the peaks of the textured concrete surface.
- b. There are no heavy puddled deposits of curing compound in the valleys of the textured concrete surface.
- c. All remaining curing compound is intact; all loose and flaking material is removed.
- d. The peaks of the textured pavement surface are rounded in profile and free of sharp edges and irregularities.
- e. The surface to be marked is dry.

## 3.2 APPLICATION

All pavement markings and patterns shall be placed as shown on the plans.

### 3.2.1 Paint

Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 5 degrees C and less than 35 degrees C. Paint temperature shall be maintained within these same limits. New asphalt pavement surfaces and new Portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint.

Paint shall be applied pneumatically with approved equipment at rate of coverage specified. The Contractor shall provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

#### 3.2.1.1 Rate of Application

- a. Reflective Markings: Pigmented binder shall be applied evenly to the pavement area to be coated at a rate of 2.9 plus or minus 0.5 square meter per liter. Glass spheres shall be applied uniformly to the wet paint on airfield pavement at a rate of 1.0

- b. Nonreflective Markings: The parking lot paint shall be applied evenly to the pavement surface to be coated at a rate of 2.9 plus or minus 0.5 square meter per liter.

#### 3.2.1.2 Drying

The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

### 3.2.2 Reflective Media

Application of reflective media shall immediately follow application of pigmented binder. Drop-on application of glass spheres shall be accomplished to insure that reflective media is evenly distributed at 3.6 to 3.9 KG per 11.24 square meters (eight to nine pounds per gallon of paint). Should there be malfunction of either paint applicator or reflective media dispenser, operations shall be discontinued immediately until deficiency is corrected.

### 3.3 MARKING REMOVAL

Pavement marking, shall be removed in the areas shown on the drawings. Removal of marking shall be as complete as possible without damage to the surface. Aggregate shall not be exposed by the removal process. After the markings are removed, the cleaned pavement surfaces shall exhibit adequate texture for remarking as specified in paragraph SURFACE PREPARATION. Contractor shall demonstrate removal of pavement marking in an area designated by the Contracting Officer. The demonstration area will become the standard for the remainder of the work.

#### 3.3.1 Equipment Operation

Equipment shall be controlled and operated to remove markings from the pavement surface, prevent dilution or removal of binder from underlying pavement, and prevent emission of blue smoke from asphalt or tar surfaces.

#### 3.3.2 Cleanup and Waste Disposal

The worksite shall be kept clean of debris and waste from the removal operations. Cleanup shall immediately follow removal operations in areas subject to air traffic. Debris shall be disposed of at approved sites.

-- End of Section --

DIVISION 3 – CONCRETE

NOT APPLICABLE

DIVISION 4 – MASONRY

04000 Division 4: Masonry - Outline Specifications

## SECTION 04000

DIVISION 4: MASONRY - OUTLINE SPECIFICATIONS  
01/02

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

## 1.1.1 Contractor Edited Guide Specifications

Depending upon the structural system used, The contractor shall edit and provide the following UFGS guide specifications for Division 4: MASONRY. All requirements contained in section 01015 (Structural) of the RFP document must be incorporated into the edited specifications.

Section 04200A, MASONRY

Section 04220A, NONBEARING MASONRY VENEER/STEEL STUD WALLS

## 1.2 REFERENCES

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A615	(1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C90	(2000) Loadbearing Concrete Masonry Units(1998)
ASTM C216	(1999) Facing Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C270	(1999b) Mortar for Unit Masonry
ASTM C476	(1999) Grout for Masonry

## 1.3 SECTION 04200A, MASONRY

## 1.3.1 Reinforcing Steel

Reinforcing Steel shall be ASTM A615, Grade 60. Splice laps shall be 48 bar diameters. All masonry shall be reinforced masonry. Vertical reinforcing steel shall be hooked into top horizontal bond beam with a standard ACI 90 degree hook.

## 1.3.2 Joint Reinforcement

Joint reinforcement shall be horizontal ladder type (minimum 9 gauge) with 16 inch maximum vertical spacing.

## 1.3.3 Concrete Masonry Units

Hollow and solid concrete masonry units shall conform to ASTM C90, Type I. Minimum f'm = 1350 psi. All horizontal and vertical layout dimensions shall be based on block coursing (including openings). Composite walls shall have

wythes brought up together. Use of adjustable ties is prohibited. Masonry shall be laid up in running bond pattern. Stack bond pattern is not permitted.

#### 1.3.4 Grout

Masonry Grout shall conform to ASTM C476 and shall have a minimum strength of 2500 psi. Grout shall be placed by Low-lift method.

#### 1.3.5 Motar

Type S conforming to ASTM C270. Minimum motar strength shall be 1800 psi. Base standards require that the motar color match the field brick color.

#### 1.3.6 Brick

Solid clay or shale brick shall conform to ASTM C216, type FBS. Brick size shall be modular. Minimum compressive strength of the brick shall be 3000 psi. Base standard brick colors are Acme Brick No. 250 (field) and 308 (trim).

-- End of Section --

DIVISION 5 – METALS

05000 Division 5: Metals - Outline Specifications

## SECTION 05000

DIVISION 5: METALS - OUTLINE SPECIFICATIONS  
01/02

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

## 1.1.1 Contractor Edited Guide Specifications

The contractor shall edit and provide the following UFGS guide specifications for Division 5: METALS. All requirements contained in section 01015 (Structural) of the RFP document must be incorporated into the edited specifications.

Section 05090A, WELDING STRUCTURAL  
 Section 05120A, STRUCTURAL STEEL  
 Section 05210A, STEEL JOISTS  
 Section 05300A, STEEL DECKING  
 Section 05500A, MISCELLANEOUS METAL

## 1.2 REFERENCES

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A615M	(1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C90	(2000) Loadbearing Concrete Masonry Units(1998)

## 1.3 SECTION 05090A, WELDING, STRUCTURAL

1.3.1 Welds : Welding shall be in accordance with AWS, E70XX.

1.3.1 All steel exposed to the weather shall be hot dipped galvanized.

## 1.4 SECTION 05120A, STRUCTURAL STEEL

1.4.1 Structural Steel, Shapes, Plates and Bars: ASTM A36M (minimum)

1.4.2 Structural Tubing: ASTM A500, Grade B

1.4.3 Steel Pipe: ASTM A53 Type S Grade B

1.4.4 High Strength Bolts: ASTM A325M

1.4.5 Anchor Bolts: ASTM A307

## 1.5 SECTION 05500A, MISCELLANEOUS METAL

1.5.1 Gutters and Downspouts, Metal Copings and Flashing: 22 ga., baked-on finish, color to match fed std 595b, No. 3617.

- 1.5.2 Exterior Pipe Railings: 1-1/2" diameter steel posts and rails. Posts to be fully grouted in steel sleeves. Prime and paint all exposed rail components.
- 1.5.3 Interior Pipe Railings: 1-1/2" diameter steel rails rigidly attached to blocking. Prime and paint all exposed rail components.

-- End of Section --

DIVISION 6 – WOOD AND PLASTICS

06000 Division 6: Wood And Plastics - Outline Specifications  
06410A Laminate Clad Architectural Casework

## SECTION 06000

DIVISION 6: WOOD AND PLASTICS - OUTLINE SPECIFICATIONS  
01/02

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

## 1.1.1 Contractor Edited Guide Specifications

The contractor shall edit and provide the following UFGS guide specifications for Division 6: WOOD AND PLASTICS:

Section 06100A, ROUGH CARPENTRY

Section 06200A, FINISH CARPENTRY

Section 06650, SOLID POLYMER FABRICATIONS

## 1.1.2 Government Edited Specifications

The contractor shall incorporate the following government-supplied, fully edited specification sections as part of the project design:

Section 06410A, LAMINATE-CLAD ARCHITECTURAL CASEWORK

## 1.1.3 Contractor Created Specifications

As part of the project design, the contractor shall create and provide the following 3-part specification in the Specsintact format:

Section 06600, PLASTIC FABRICATIONS (SOLID PHENOLIC LABORATORY COUNTERTOPS)

## 1.2 SECTION 06100A, ROUGH CARPENTRY

The contractor edited specification section shall include the following material physical characteristics and performance criteria:

A. All wood blocking shall be No. 2 Grade, stud grade or better.

## 1.3 SECTION 06200A, FINISH CARPENTRY

## 1.3.1 Material Criteria

The contractor edited specification section shall include the following material physical characteristics and performance criteria:

A.  
Specific criteria and specifications shall be provided for wood utility shelving and other finished wood items or components shown on the drawings or called out in the space data sheets.

B. Stain and finish combination for wood door veneers shall match Wilsonart plastic laminate #7816 Solar Oak. Finish shall be

polyurethane.

#### 1.4 SECTION 06600, PLASTIC FABRICATIONS (SOLID PHENOLIC LABORATORY TOPS)

##### 1.4.1 Material and Performance Criteria

The contractor edited specification section shall include the following material physical characteristics and performance criteria:

- A. Solid phenolic materials shall be equal in physical properties and performance characteristics to Trespa "TopLab Plus".
- B. Material thickness: .
- C. Minimum performance requirements:
  - 1) Modulus of Elasticity: 1,500, 000 psi (10,335 MPa).
  - 2) Shear Strength: 2000 psi (14 MPa).
  - 3) Compressive Strength: 24,000 psi (165 MPa).
  - 4) Weight: 93 pcf.
  - 5) Fire Performance: Maximum flame spread of 25 per ASTM E 84.
  - 6) Porosity: Nonporous surfaces and edges.
  - 7) Chemical Resistance: Provides minimum performance necessary when tested in accordance with SEFA 8.

##### 1.4.2 Installation Criteria

The contractor edited specification shall include the following fabrication and installation criteria:

- A. Front edge detail shall incorporate a mitered edge with a face width.
- B. Fabricator/installer shall be ISO 9001 certified and approved by the manufacturer of the material.
- C. Installation shall include matching high backsplash and side splashes with mitered edges, permanently adhered to the countertop and adjacent wall surfaces.

#### 1.5 SECTION 06650, SOLID POLYMER FABRICATIONS

##### 1.5.1 Material Criteria

The contractor edited specification section shall include the following material physical characteristics and performance criteria for solid polymer material:

- A. All horizontal applications of solid polymer, solid surfacing material shall be thickness. Vertical application as wall cladding (panels) shall be in thickness.
- B. All solid polymer, solid surfacing material shall be 100 percent

acrylic. Blends or reinforced compositions are prohibited.

C. All solid surfacing material shall incorporate a particulate pattern (non-solid color appearance) equal in appearance to Corian "Sierra" or "Summit".

#### 1.5.2 Fabrication Criteria

The contractor edited specification section shall include the following fabrication criteria:

A. Solid surfacing countertops, vanity tops, and window stools shall utilize a solid surfacing bullnose profile at all exposed edges.

B. Solid surfacing countertops shall include a high coved backsplash and matching loose side splashes. Coved backsplash shall be fabricated using the V-Groove method as a cost savings measure. Top edge of splashes shall be chamfered.

C. Clear silicone sealant shall be applied at the juncture of all walls and solid surfacing material.

-- End of Section --

## SECTION 06410A

LAMINATE CLAD ARCHITECTURAL CASEWORK  
07/01

## 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 basic designation only.

## ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI Qual Stds (1999) Architectural Woodwork Quality Standards.

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3 (1995) High Pressure Decorative Laminates

NEMA LD 3.1 (1995) Performance, Application, Fabrication, and Installation of High Pressure Decorative Laminates

## AMERICAN NATIONAL STANDARD INSTITUTE (ANSI)

ANSI A161.2 (1998) Decorative Laminate Countertops, Performance Standards for Fabricated High Pressure

ANSI A208.1 (1999) Particleboard Mat Formed Woods

ANSI A208.2 (1994) Medium Density Fiberboard (MDF)

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1037 (1999) Evaluating Properties of Wood-Base Fiber and Particle Panel Materials

ASTM E 84 (2000a) Surface Burning Characteristics of Building Materials

ASTM F 547 (1977; R 1995) Definition of Terms Relating to Nails for Use with Wood and Wood-Based Materials.

## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA A156.9 (1994) Cabinet Hardware

## NSF INTERNATIONAL (NSF)

NSF 2 (1996) Food Equipment

## NATIONAL WOOD WINDOW &amp; DOOR ASSOCIATION (NWWDA)

NWWDA I.S. 1-A

(1997) Architectural Wood Flush Doors

## 1.2 GENERAL DESCRIPTION

Work in this section includes laminate clad custom casework cabinets as shown on the drawings and as described in this specification. This Section includes high-pressure laminate surfacing and cabinet hardware. Recyclable materials shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS. All exposed and semi-exposed surfaces, whose finish is not otherwise noted on the drawings or finish schedule, shall be sanded smooth and shall receive a clear finish of polyurethane. Wood finish may be shop finished or field applied in accordance with Section 09900 PAINTING, GENERAL.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. All items designated with a "G", including product literature, calculations, component data, certificates, diagrams, drawings, and samples shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

## SD-02 Shop Drawings

Shop Drawings; G, AE  
Installation; G, AE

Shop drawings showing all fabricated casework items in plan view, elevations and cross-sections to accurately indicate materials used, details of construction, dimensions, methods of fastening and erection, and installation methods proposed. Shop drawing casework items shall be clearly cross-referenced to casework items located on the project drawings. Shop drawings shall include a color schedule of all casework items to include all countertop, exposed, and semi-exposed cabinet finishes to include finish material manufacturer, pattern, and color.

## SD-03 Product Data

Wood Materials; G, AE  
Wood Finishes; G, AE  
Finish Schedule; G, AE

Descriptive data which provides narrative written verification of all types of construction materials and finishes, methods of construction, etc. not clearly illustrated on the submitted shop drawings. Data shall provide written verification of conformance with AWI Qual Stds for the quality indicated to include materials, tolerances, and types of construction. Both the manufacturer of

materials and the fabricator shall submit available literature which describes re-cycled product content, operations and processes in place that support efficient use of natural resources, energy efficiency, emissions of ozone depleting chemicals, management of water and operational waste, indoor environmental quality, and other production techniques supporting sustainable design and products.

#### SD-04 Samples

Plastic Laminates; G, AE

Two samples of each plastic laminate pattern and color. Samples shall be a minimum of in size.

Cabinet Hardware; G, AE

One sample of each cabinet hardware item specified to include hinges, pulls, and drawer glides.

#### SD-07 Certificates

Quality Assurance; G, AE

Laminate Clad Casework; G, AE

A quality control statement which illustrates compliance with and understanding of AWI Qual Stds requirements, in general, and the specific AWI Qual Stds requirements provided in this specification. The quality control statement shall also certify a minimum of ten years contractor's experience in laminate clad casework fabrication and construction. The quality control statement shall provide a list of a minimum of five successfully completed projects of a similar scope, size, and complexity.

### 1.4 QUALITY ASSURANCE

Unless otherwise noted on the drawings, all materials, construction methods, and fabrication shall conform to and comply with the premium grade quality standards as outlined in AWI Qual Stds, Section 400G and Section 400B for laminate clad cabinets. These standards shall apply in lieu of omissions or specific requirements in this specification. Contractors and their personnel engaged in the work shall be able to demonstrate successful experience with work of comparable extent, complexity and quality to that shown and specified. Contractor must demonstrate knowledge and understanding of AWI Qual Stds requirements for the quality grade indicated.

### 1.5 MOCK-UP

Prior to final approval of shop drawings, a full-size mock-up shall be provided of a typical floor cabinet and wall cabinet. The mock-up shall include all components and hardware necessary to illustrate a completed unit and shall include a minimum of one door and one drawer assembly. The completed mock-up shall include countertops and back splashes where specified. The mock-up shall utilize specified finishes in the patterns and colors as indicated on the drawings. Upon disapproval, the Contractor shall rework or remake the mock-up until approval is secured. Rejected units shall be removed from the jobsite. Approved mock-up may remain as part of the finished work.

## 1.6 DELIVERY AND STORAGE

Casework may be delivered knockdown or fully assembled. All units shall be delivered to the site in undamaged condition, stored off the ground in fully enclosed areas, and protected from damage. The storage area shall be well ventilated and not subject to extreme changes in temperature or humidity.

## 1.7 SEQUENCING AND SCHEDULING

Work shall be coordinated with other trades. Units shall not be installed in any room or space until painting, and ceiling installation are complete within the room where the units are located. Floor cabinets shall be installed before finished flooring materials are installed.

## 1.8 PROJECT/SITE CONDITIONS

Field measurements shall be verified as indicated in the shop drawings before fabrication.

## PART 2 PRODUCTS

### 2.1 WOOD MATERIALS

#### 2.1.1 Lumber

All framing lumber shall be kiln-dried Grade III to dimensions as shown on the drawings. Frame front, where indicated on the drawings, shall be nominal hardwood.

##### 2.1.1.1 Standing and Running Trim

Standing or running trim casework components which are specified to receive a transparent finish shall be red oak hardwood species, plain sawn. AWI grade shall be premium. Location, shape, and dimensions shall be as indicated on the drawings.

#### 2.1.2 Panel Products

##### 2.1.2.1 Plywood

All plywood panels used for framing purposes shall be veneer core hardwood plywood, AWI Qual Stds Grade AA. Nominal thickness of plywood panels shall be as indicated in this specification and on the drawings.

##### 2.1.2.2 Particleboard

All particleboard shall be industrial grade, medium density ( ), thick. A moisture-resistant particleboard in grade Type 2-M-2 or 2-M-3 shall be used as the substrate for plastic laminate covered doors and drawer fronts. Particleboard shall meet the minimum standards listed in ASTM D 1037 and ANSI A208.1.

##### 2.1.2.3 Medium Density Fiberboard

Medium density fiberboard (MDF) shall be an acceptable panel substrate where noted on the drawings. Medium density fiberboard shall meet the minimum standards listed in ANSI A208.2.

## 2.2 SOLID POLYMER MATERIAL

Solid surfacing casework countertops shall conform to the requirements of Section 06650 SOLID POLYMER FABRICATIONS.

## 2.3 HIGH PRESSURE DECORATIVE LAMINATE (HPDL)

All plastic laminates shall meet the requirements of NEMA LD 3 and ANSI A161.2 for high-pressure decorative laminates. Design, colors, surface finish and texture, and locations shall be as indicated on the drawings. Plastic laminate types and nominal minimum thicknesses for casework components shall be as indicated in the following paragraphs.

### 2.3.1 Horizontal General Purpose Standard (HGS) Grade

Horizontal general purpose standard grade plastic laminate shall be in thickness. This laminate grade is intended for horizontal surfaces where postforming is not required.

### 2.3.2 Vertical General Purpose Standard (VGS) Grade

Vertical general purpose standard grade plastic laminate shall be in thickness. This laminate grade is intended for exposed exterior vertical surfaces of casework components where postforming is not required.

### 2.3.3 Horizontal General Purpose Postformable (HGP) Grade

Horizontal general purpose postformable grade plastic laminate shall be in thickness. This laminate grade is intended for horizontal surfaces where post forming is required.

### 2.3.4 Vertical General Purpose Postformable (VGP) Grade

Vertical general purpose postformable grade plastic laminate shall be in thickness. This laminate grade is intended for exposed exterior vertical surfaces of components where postforming is required for curved surfaces.

### 2.3.5 Cabinet Liner Standard (CLS) Grade

Cabinet liner standard grade plastic laminate shall be in thickness. This laminate grade is intended for light duty semi-exposed interior surfaces of casework components.

### 2.3.6 Backing Sheet (BK) Grade

Undecorated backing sheet grade laminate is formulated specifically to be used on the backside of plastic laminated panel substrates to enhance dimensional stability of the substrate. Backing sheet thickness shall be .

Backing sheets shall be provided for all laminated casework components where plastic laminate finish is applied to only one surface of the component substrate.

## 2.4 THERMOSET DECORATIVE OVERLAYS (MELAMINE)

Thermoset decorative overlays (melamine panels) shall be used for casework cabinet interior and drawer interior surfaces where indicated on the drawings.

## 2.5 EDGE BANDING

Edge banding for casework doors and drawer fronts shall be PVC vinyl and shall be thick. Material width shall be . Color and pattern shall be as indicated on the drawings.

## 2.6 CABINET HARDWARE

All hardware shall conform to BHMA A156.9, unless otherwise noted, and shall consist of the following components:

- a. Door Hinges: Concealed, self-closing European-type, BHMA No. B01602. Minimum swing shall be 125 degrees.
- b. Cabinet Pulls: Back mounted, 4-inches in length, wire pull type.
- c. Drawer Slide: Side mounted type, BHMA No. B05051 with full extension and a minimum load capacity. Slides shall include an integral stop to avoid accidental drawer removal.
- d. Adjustable Shelf Support System:
  - 1) Recessed (mortised) metal standards, BHMA No. B04071, finish: brushed. Support clips for the standards shall be closed type, BHMA No. B04081], finish: brushed.

## 2.7 FASTENERS

Nails, screws, and other suitable fasteners shall be the size and type best suited for the purpose and shall conform to ASTM F 547 where applicable.

## 2.8 ADHESIVES, CAULKS, AND SEALANTS

### 2.8.1 Adhesives

Adhesives shall be of a formula and type recommended by AWI. Adhesives shall be selected for their ability to provide a durable, permanent bond and shall take into consideration such factors as materials to be bonded, expansion and contraction, bond strength, fire rating, and moisture resistance. Adhesives shall meet local regulations regarding VOC emissions and off-gassing.

#### 2.8.1.1 Wood Joinery

Adhesives used to bond wood members shall be a Type II for interior use urea-formaldehyde resin formula. Adhesives shall withstand a bond test as described in NWWDA I.S. 1-A.

#### 2.8.1.2 Laminate Adhesive

Adhesive used to join high-pressure decorative laminate to wood shall be a water-based contact adhesive. PVC edgebanding shall be adhered using a polymer-based hot melt glue.

### 2.8.2 Caulk

Caulk used to fill voids and joints between laminated components and between laminated components and adjacent surfaces shall be clear, 100 percent silicone.

### 2.8.3 Sealant

Sealant shall be of a type and composition recommended by the substrate manufacturer to provide a moisture barrier at sink cutouts and all other locations where unfinished substrate edges may be subjected to moisture.

## 2.9 WOOD FINISHES

Paint, stain, varnish and their applications required for laminate clad casework components shall be as indicated in Section 09900 PAINTING, GENERAL. Color and location shall be as indicated on the drawings.

## 2.10 FABRICATION

Fabrication and assembly of components shall be accomplished at the shop site to the maximum extent possible. Construction and fabrication of cabinets and their components shall meet or exceed the requirements for AWI premium grade unless otherwise indicated in this specification. Cabinet style, in accordance with AWI Qual Stds, Section 400-G descriptions, shall be flush overlay.

### 2.10.1 Base and Wall Cabinet Case Body

Frame members shall be glued-together, kiln-dried hardwood lumber. Top corners, bottom corners, and cabinet bottoms shall be braced with either hardwood blocks or water-resistant glue and nailed in place metal or plastic corner braces. Cabinet components shall be constructed from the following materials and thicknesses:

- a. Body Members (Ends, Divisions, Bottoms, and Tops): particleboard or medium density fiberboard 9MDF) panel product.
- b. Face Frames and Rails: hardwood lumber.
- c. Shelving: particleboard panel product.
- d. Cabinet Backs: veneer core plywood panel product.
- e. Drawer Sides, Backs, and Subfronts: panel product.
- f. Drawer Bottoms: particleboard or medium density fiberboard 9MDF) panel product.
- g. Door and Drawer Fronts: particleboard panel product.

#### 2.10.1.1 Joinery Method for Case Body Members

- a. Tops, Exposed Ends, and Bottoms.
  - 1) Steel "European" assembly screws ( from end, on center, fasteners will not be visible on exposed parts).
  - 2) Doweled, glued under pressure (approx. 4 dowels per of joint).
  - 3) Stop dado, glued under pressure, and either nailed, stapled or screwed (fasteners will not be visible on exposed parts).
- b. Exposed End Corner and Face Frame Attachment.

1) For mitered joint: lock miter or spline or biscuit, glued under pressure (no visible fasteners).

2) For non-mitered joint (90 degree): butt joint glued under pressure (no visible fasteners).

c. Cabinet Backs (Wall Hung Cabinets): Wall hung cabinet backs must not be relied upon to support the full weight of the cabinet and its anticipated load for hanging/mounting purposes. Method of back joinery and hanging/mounting mechanisms should transfer the load to case body members. Fabrication method shall be:

1) Full bound, captured in grooves on cabinet sides, top, and bottom. Cabinet backs for floor standing cabinets shall be side bound, captured in grooves; glued and fastened to top and bottom.

d. Cabinet Backs (Floor Standing Cabinets).

1) Side bound, captured in grooves; glued and fastened to top and bottom.

e. Wall Anchor Strips shall be required for all cabinets with backs less than thick. Strips shall consist of minimum thick lumber, minimum width; securely attached to wall side of cabinet back - top and bottom for wall hung cabinets, top only for floor standing cabinets.

#### 2.10.2 Cabinet Floor Base

Floor cabinets shall be mounted on a base constructed of nominal thick lumber. Base assembly components shall be treated lumber. Finished height for each cabinet base shall be not less than the full height of the installed, specified wall base. Bottom edge of the cabinet door or drawer face shall extend below the top of the base as indicated on the drawings.

#### 2.10.3 Cabinet Door and Drawer Fronts

Door and drawer fronts shall be fabricated from medium density particleboard. All door and drawer front edges shall be surfaced with PVC edgbanding, color and pattern as indicated on the drawings.

#### 2.10.4 Drawer Assembly

Drawer components shall consist of a removable drawer front, sides, backs, and bottom. Drawer components shall be constructed of the following materials and thicknesses:

a. Drawer Sides and Backs For Laminate Finish: thick 7-ply hardwood veneer core substrate.

b. Drawer Sides and Back For Thermoset Decorative Overlay (melamine) Finish: thick medium density particleboard or MDF fiberboard substrate.

c. Drawer Bottom: thick veneer core panel product for transparent or plastic laminate finish or thermoset decorative overlay melamine panel product.

#### 2.10.4.1 Drawer Assembly Joinery Method

a. Multiple dovetail (all corners) or French dovetail front/dadoed back, glued under pressure.

or

b. Doweled, glued under pressure.

or

c. Lock shoulder, glued and pin nailed.

d. Bottoms shall be set into sides, front, and back, deep groove with a minimum standing shoulder.

#### 2.10.5 Shelving

Shelving shall be fabricated from medium density particleboard. All shelving top and bottom surfaces shall be finished with HPDL plastic laminate. Shelf edges shall be finished in a PVC edgebanding.

##### 2.10.5.1 Shelf Support System

The shelf support system shall be recessed (mortised) metal shelf standards. Standards shall be mortised flush with the finishes surface of the cabinet interior side walls, two per side. Standards shall be positioned and spaced on the side walls to provide a stable shelf surface that eliminates tipping when shelf front is weighted. Standards shall be installed and adjusted vertically to provide a level, stable shelf surface when clips are in place.

#### 2.10.6 Laminate Application

Laminate application to substrates shall follow the recommended procedures and instructions of the laminate manufacturer and NEMA LD 3.1, using tools and devices specifically designed for laminate fabrication and application.

Provide a balanced backer sheet (Grade BK) wherever only one surface of the component substrate requires a plastic laminate finish. Apply required grade of laminate in full uninterrupted sheets consistent with manufactured sizes using one piece for full length only, using adhesives specified herein or as recommended by the manufacturer. Fit corners and joints hairline. All laminate edges shall be machined flush, filed, sanded, or buffed to remove machine marks and eased (sharp corners removed). Clean up at easing shall be such that no overlap of the member eased is visible. Fabrication shall conform to NEMA LD 3.1 and ANSI A161.2. Laminate types and grades for component surfaces shall be as follows unless otherwise indicated on the drawings:

a. Base/Wall Cabinet Case Body.

1) Exterior (exposed) surfaces to include exposed and semi-exposed face frame surfaces: HPDL Grade VGS.

2) Interior (semi-exposed) vertical surfaces and inside top: HPDL Grade CLS or Thermoset Decorative Overlay (melamine).

3) Interior bottom surface: HPDL Grade HGS.

b. Adjustable Shelving.

- 1) Top and bottom surfaces: HPDL Grade HGS.
- 2) All edges: PVC edge banding.

c. Fixed Shelving.

- 1) Top and bottom surfaces: HPDL Grade HGS.
- 2) Exposed edges: PVC edge banding.

d. Door, Drawer Fronts, Access Panels.

- 1) Exterior (exposed) and interior (semi-exposed) faces: HPDL Grade VGS.
- 2) Edges: PVC edge banding.

e. Drawer Assembly.

All interior and exterior surfaces: HPDL Grade CLS or Thermoset Decorative Overlay (melamine).

2.10.6.1 Tolerances

Flushness, flatness, and joint tolerances of laminated surfaces shall meet the AWI Qual Stds premium grade requirements.

2.10.7 Finishing

2.10.7.1 Filling

No fasteners shall be exposed on laminated surfaces. All nails, screws, and other fasteners in non-laminated cabinet components shall be countersunk and the holes filled with wood filler consistent in color with the wood species.

2.10.7.2 Sanding

All surfaces requiring coatings shall be prepared by sanding with a grit and in a manner that scratches will not show in the final system.

2.10.7.3 Coatings

Types, method of application and location of casework finishes shall be in accordance with the finish schedule, drawings and Section 09900 PAINTING, GENERAL. All cabinet reveals shall be painted.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall comply with applicable requirements for AWI Qual Stds premium quality standards. Countertops and fabricated assemblies shall be installed level, plumb, and true to line, in locations shown on the drawings. Cabinets and other laminate clad casework assemblies shall be attached and anchored securely to the floor and walls with mechanical fasteners that are appropriate for the wall and floor construction.

### 3.1.1 Anchoring Systems

#### 3.1.1.1 Floor

Base cabinets shall utilize a floor anchoring system as detailed on the drawings. Anchoring and mechanical fasteners shall not be visible from the finished side of the casework assembly. Cabinet assemblies shall be attached to anchored bases without visible fasteners as indicated in the drawings. Where assembly abutts a wall surface, anchoring shall include a minimum thick lumber or panel product hanging strip, minimum width; securely attached to the top of the wall side of the cabinet back.

#### 3.1.1.2 Wall

Cabinets to be wall mounted shall utilize minimum thick lumber or panel product hanging strips, minimum width; securely attached to the wall side of the cabinet back, both top and bottom.

### 3.1.2 Hardware

Casework hardware shall be installed in types and locations as indicated on the drawings. Where fully concealed European-style hinges are specified to be used with particleboard or fiberboard doors, the use of plastic or synthetic insertion dowels shall be used to receive "Euroscrows". The use of wood screws without insertion dowels is prohibited.

### 3.1.3 Doors, Drawers and Removable Panels

The fitting of doors, drawers and removable panels shall be accomplished within target fitting tolerances for gaps and flushness in accordance with AWI Qual Stds premium grade requirements.

### 3.1.4 Plumbing Fixtures

Sinks, sink hardware, and other plumbing fixtures shall be installed in locations as indicated on the drawings and in accordance with Section 15400 PLUMBING, GENERAL PURPOSE.

-- End of Section --

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

07000  
07416A

Division 7: Thermal And Moisture Protection - Outline Specifications  
Structural Standing Seam Metal Roof (Sssmr) System

SECTION 07000

DIVISION 7: THERMAL AND MOISTURE PROTECTION - OUTLINE SPECIFICATIONS  
**[03/01]**

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Contractor Edited Guide Specifications

The contractor shall edit and provide the following UFGS guide specifications for Division 7:

Section 07220A ROOF INSULATION

Section 07240 EXTERIOR INSULATION AND FINISH SYSTEMS

Section 07600A, SHEET METAL WORK GENERAL

Section 007840A, FIRESTOPPING

Section 07900A, JOINT SEALING

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.

1.3 Section 07240, EXTERIOR INSULATION AND FINISH SYSTEMS

EIFS system shall be mechanically fastened. Finish will be shiptrowel. Base color to be fed std 595b, No. x3617. The Contractor will also provide an accent/trim color, fed std 595b, No. x0122, if so directed by the Contracting Officer.

1.4 Not Used

1.4 Section 07600A, SHEET METAL WORK GENERAL

Non metallic through wall flashing is not allowed.

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --

## SECTION 07416A

STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM  
11/01

## 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 basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA ADM (2000) Aluminum Design Manual:  
Specification & Guidelines for Aluminum  
Structures

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 335 (1989) Specification for Structural Steel  
Buildings - Allowable Stress Design,  
Plastic Design

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG-973 (1996) Cold-Formed Steel Design Manual

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 463/A 463M (2000) Steel Sheet, Aluminum-Coated, by  
the Hot-Dip Process

ASTM A 653/A 653M (2000) Steel Sheet, Zinc-Coated  
(Galvanized) or Zinc-Iron Alloy-Coated  
(Galvannealed) by the Hot-Dip Process

ASTM A 792/A 792M (1999) Steel Sheet, 55% Aluminum-Zinc  
Alloy-Coated by the Hot-Dip Process

ASTM B 209 (2000) Aluminum and Aluminum-Alloy Sheet  
and Plate

ASTM B 209M (2000) Aluminum and Aluminum-Alloy Sheet  
and Plate (Metric)

ASTM C 1177/C 1177M (1999) Glass Mat Gypsum Substrate for Use  
as Sheathing

ASTM C 1289 (1998) Faced Rigid Cellular  
Polyisocyanurate Thermal Insulation Board

ASTM C 518 (1998) Steady-State Heat Flux Measurements  
and Thermal Transmission Properties by  
Means of the Heat Flow Meter Apparatus

ASTM C 991 (1998) Flexible Glass Fiber Insulation for Pre-Engineered Metal Buildings

ASTM D 1308 (1987; R 1998) Effect of Household Chemicals on Clear and Pigmented Organic Finishes

ASTM D 1654 (1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

ASTM D 2244 (1995) Calculation of Color Differences from Instrumentally Measured Color Coordinates

ASTM D 2247 (1999) Testing Water Resistance of Coatings in 100% Relative Humidity

ASTM D 2794 (1993; R 1999e1) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

ASTM D 3359 (1997) Measuring Adhesion by Tape Test

ASTM D 4214 (1998) Evaluating Degree of Chalking of Exterior Paint Films

ASTM D 4397 (1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

ASTM D 522 (1993a) Mandrel Bend Test of Attached Organic Coatings

ASTM D 523 (1989; R 1999) Specular Gloss

ASTM D 5894 (1996) Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)

ASTM D 610 (1995) Evaluating Degree of Rusting on Painted Steel Surfaces

ASTM D 714 (1987; R 1994e1) Evaluating Degree of Blistering of Paints

ASTM D 968 (1993) Abrasion Resistance of Organic Coatings by Falling Abrasive

ASTM E 1592 (1998) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference

ASTM E 84 (2000a) Surface Burning Characteristics of Building Materials

ASTM E 96 (2000) Water Vapor Transmission of Materials

ASTM G 154 (2000ael) Standard Practice for Operating  
Fluorescent Light Apparatus for UV  
Exposure of Nonmetallic Materials

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (1998) Minimum Design Loads for Buildings  
and Other Structures

STEEL JOIST INSTITUTE (SJI)

SJI Specs & Tables (1994) Standard Specifications Load Tables  
and Weight Tables for Steel Joists and  
Joist Girders

## 1.2 GENERAL REQUIREMENTS

The Contractor shall furnish a commercially available roofing system which satisfies all requirements contained herein and has been verified by load testing and independent design analyses to meet the specified design requirements.

### 1.2.1 Structural Standing Seam Metal Roof (SSSMR) System

The SSSMR system covered under this specification shall include the entire roofing system; the standing seam metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with ASTM E 1592. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, skylights; interior or exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system.

### 1.2.2 Manufacturer

The SSSMR system shall be the product of a manufacturer who has been in the practice of manufacturing and designing SSSMR systems for a period of not less than 3 years and has been involved in at least five projects similar in size and complexity to this project.

### 1.2.3 Installer

The installer shall be certified by the SSSMR system manufacturer to have experience in installing at least three projects that are of comparable size, scope and complexity as this project for the particular roof system furnished. The installer may be either employed by the manufacturer or be an independent installer.

### 1.2.4 Manufacturer's Representative

A representative of the SSSMR manufacturer, who is familiar with the design of the roof system supplied and experienced in the erection of roof systems similar in size to the one required under this contract, shall be present at the job site during installation of the SSSMR to assure that the roof system meets specified requirements. The manufacturer's representative shall be either an employee of the manufacturer with at least two years

experience in installing the roof system or an employee of an independent installer that is certified by the SSSMR manufacturer to have two years of experience in installing similar roof systems.

1.3 DESIGN REQUIREMENTS

The design of the SSSMR system shall be provided by the Contractor as a complete system. Members and connections not indicated on the drawings shall be designed by the Contractor. Roof panels, components, transitions, accessories, and assemblies shall be supplied by the same roofing system manufacturer.

1.3.1 Design Criteria

Design criteria shall be in accordance with ASCE 7.

1.3.2 Dead Loads

The dead load shall be the weight of the SSSMR system. Collateral loads such as sprinklers, mechanical and electrical systems, and ceilings shall not be attached to the panels.

1.3.3 Live Loads

1.3.3.1 Concentrated Loads

The panels and anchor clips shall be capable of supporting a 1335 N concentrated load. The concentrated load shall be applied at the panel midspan and will be resisted by a single standing seam metal roof panel assumed to be acting as a beam. The undeformed shape of the panel shall be used to determine the section properties.

1.3.3.2 Uniform Loads

The panels and concealed anchor clips shall be capable of supporting a minimum uniform live load of [960] [\_\_\_\_\_] Pa.

1.3.4 Roof Snow Loads

The design roof snow loads shall be as shown on the contract drawings.

1.3.5 Wind Loads

The design uplift pressures for the roof system shall be as indicated on the contract drawings. The safety factor listed below shall be applied to the design force and compared against the ultimate capacity. Prying shall be considered when figuring fastener design loads.

- a. Single fastener in each connection.....3.0
- b. Two or more fasteners in each connection...2.25

1.3.6 Thermal Loads

Roof panels shall be free to move in response to the expansion and contraction forces resulting from a total temperature range of 220 degrees C during the life of the structure.

1.3.7 Framing Members Supporting the SSSMR System

Structural cold formed steel framing members and their connections shall be designed in accordance with AISI SG 673. Maximum deflections under applied dead and live load and/or wind load for subpurlins shall not exceed 1/180 times the span length and shall be based on constraint conditions at the supports. Subpurlins shall be designed to span from structural member to structural member. Attachment to a metal deck, if present, is permitted for lateral stability only. Subpurlins must be adequately braced for both positive and negative bending. Subpurlins are required at all clip locations in installations above a metal deck. Attaching clips through rigid insulation to structure is prohibited.

#### 1.3.8 Roof Panels Design

Steel panels shall be designed in accordance with AISI SG-973. Aluminum panels shall be designed in accordance with AA ADM. The structural section properties used in the design of the panels shall be determined using the unloaded shape of the roof panels. The calculated panel deflection from concentrated loads shall not exceed 1/180 of the span length. The calculated panel deflection under applied live load, snow, or wind load shall not exceed 1/180 times the span length. Deflections shall be based on panels being continuous across three or more supports, fastener spacing, and the ability of the panel to rotate freely on the support. Deflection shall be calculated and measured along the major ribs of the panels.

#### 1.3.9 Accessories and Their Fasteners

Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces. There shall be a minimum of two fasteners per clip. Single fasteners with a minimum diameter of 9 mm will be allowed when the supporting structural members are prepunched or predrilled. The design uplift force for the accessory connections and the factors of safety, shall be as required in subparagraph 1.3.5 Wind Loads.

### 1.4 PERFORMANCE REQUIREMENTS

The SSSMR shall be tested for wind uplift resistance in accordance with ASTM E 1592; SSSMR systems previously tested and approved by the Corps of Engineers' STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF SSMRS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE may be acceptable. Two tests shall be performed. Test 1 shall simulate the edge condition with one end having crosswise restraint and other end free of crosswise restraint. The maximum span length for the edge condition shall be 750 mm. Test 2 shall simulate the interior condition with both ends free of crosswise restraint. The maximum span length for the interior condition shall be 1.5 m. External reinforcement, such as clamps on the ribs, shall not be installed to improve uplift resistance. Bolts through seams shall not be installed.

#### 1.4.1 Concealed Anchor Clip Connection to Building Structure

The tested capacity of fasteners used to connect the concealed anchor clips to subpurlins, structural purlins, or metal roof deck shall be determined from tests supplied by the fastener manufacturer or an independent testing laboratory. Tests shall be performed on fasteners and supporting members that are made from the same materials and are equal or less in size and thickness to the fasteners and supporting members used in the actual roof

installation. The maximum uplift loading used in the test shall be the design uplift force multiplied by the factor of safety. The design uplift force and the factors of safety shall be as required in subparagraph 1.3.5 Wind Loads.

#### 1.4.2 Subpurlin Connection to Building Structure

The tested capacity of fasteners used to connect the subpurlins to structural purlins or through metal roof deck to building structure shall be determined from tests supplied by the fastener manufacturer or an independent testing laboratory. Tests shall be performed on fasteners and supporting members that are made from the same materials and are equal or less in size and thickness to the fasteners and supporting members used in the actual roof installation. The maximum uplift loading used in the test shall be the design uplift force multiplied by the factor of safety. The factors of safety and the design uplift force shall be as required in subparagraph 1.3.5 Wind Loads.

#### 1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

##### SD-02 Shop Drawings

Structural Standing Seam Metal Roof System; G, [\_\_\_\_\_].

Metal roofing drawings and specifications and erection drawings; shop coating and finishing specifications; and other data as necessary to clearly describe design, materials, sizes, layouts, standing seam configuration, construction details, provisions for thermal movement, line of panel fixity, fastener sizes and spacings, sealants and erection procedures. Drawings shall reflect the intent of the architectural detailing using the manufacturer's proprietary products and fabricated items as required. The SSSMR system shop drawings shall be provided by the metal roofing manufacturer.

Drawings; G, [\_\_\_\_\_]

The shop drawings shall also include the SSSMR component details that resulted from the design calculations and the wind uplift testing required herein. The shop drawings also shall show the locations and configuration of any thermal spacer blocks or barriers. Subpurlin layouts shall be shown and the spacing must be coordinated with the metal deck configuration, lap locations, and sidelap configurations.

##### SD-03 Product Data

Design Analysis; G, [\_\_\_\_\_].

Design analysis signed by a Registered Professional Engineer, and submitted for approval prior to beginning of manufacture. The design analysis shall include, but not be limited to the following information:

- a. A list of the design loads.
- b. Thermal movements that will result from the specified temperature range. The calculations shall be accompanied by details from the manufacturer that demonstrate how installed concealed anchor clips and other roof system devices will accommodate the required thermal movement.
- c. Concentrated load and roof live load analysis.
- d. Subpurlin catalog cuts, section property information and sketches to indicate that the subpurlin geometry has been coordinated with the metal deck configuration and that the subpurlins will nest properly in the metal deck flutes.

\*\*\*\*\*  
 NOTE: The following submittal requirements apply to metal building systems only.  
 \*\*\*\*\*

- d. Complete calculations of the support system ,including purlins and/or subpurlins designed in accordance with subparagraph: Framing Members.
- e. Wind forces on various parts of the roof. Both positive and negative pressures shall be calculated based on the criteria in subparagraph: Design Conditions and parameters in subparagraph: Wind Uplift Loads. The resultant wind uplift forces and dimensions of the edge and corner zones will be shown on an isometric view of the roof."

Qualifications; [\_\_\_\_], [\_\_\_\_].

Qualifications of the manufacturer and installer.

SD-04 Samples

Accessories; [\_\_\_\_], [\_\_\_\_].

One sample of each type of flashing, trim, closure, thermal spacer block, cap and similar items. Size shall be sufficient to show construction and configuration.

Roof Panels; [\_\_\_\_], [\_\_\_\_].

One piece of each type to be used, 225 mm long, full width.

Factory Color Finish; [\_\_\_\_], [\_\_\_\_].

Three 75 by 125 mm samples of each type and color.

Fasteners; [\_\_\_\_], [\_\_\_\_].

Two samples of each type to be used, with statement regarding intended use. If so requested, random samples of bolts, nuts, and washers as delivered to the job site shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with

specified requirements.

Insulation; [\_\_\_\_], [\_\_\_\_].

One piece, 300 by 300 mm, of each type and thickness to be used, with a label indicating the rated permeance (if faced) and R-values. The flame spread, and smoke developed rating shall be shown on the label or provided in a letter of certification.

Gaskets and Insulating Compounds; [\_\_\_\_], [\_\_\_\_].

Two samples of each type to be used and descriptive data.

Sealant; [\_\_\_\_], [\_\_\_\_].

One sample, approximately 0.5 kg, and descriptive data.

Concealed Anchor Clips; [\_\_\_\_], [\_\_\_\_].

Two samples of each type used.

Subpurlins; [\_\_\_\_], [\_\_\_\_].

One piece, 225 mm long.

EPDM Rubber Boots; [\_\_\_\_], [\_\_\_\_].

One piece of each type.

External Attachments;; [\_\_\_\_], [\_\_\_\_]

Two samples of every type of permanent external attachment either, clips or clamps, used in the tested system to increase the rated capacity of the roofing system

#### SD-06 Test Reports

Test Report for Uplift Resistance of the SSSMR; G, [\_\_\_\_].

The report shall include the following information:

- a. Details of the SSSMR system showing the roof panel cross-section with dimensions and thickness.
- b. Details of the anchor clip, dimensions, and thickness.
- c. Type of fasteners, size, and the number required for each connection.
- d. Purlins/subpurlins size and spacing used in the test.
- e. Description of the seaming operation including equipment used.
- f. Maximum allowable uplift pressures. These pressures are determined from the ultimate load divided by a factor of safety equal to 1.65.
- g. Any additional information required to identify the SSSMR

system tested.

h. Signature and seal of an independent registered engineer who witnessed the test.

i. Fastener Test Report (Additional Requirement)?  
 Manufacturer's test report or independent test laboratory report. Tests shall be performed on fasteners and supporting members that are made from the same materials and are equal or less in size and thickness to the fasteners and supporting members used in the actual roof installation.

j. Panel Finish Color (Additional Requirement)? Test results shall be submitted for all roofing panels showing the results of testing in accordance with the color finish tests specified in paragraphs 2.6.1 through 2.6.8.

SD-07 Certificates

Structural Standing Seam Metal Roof System; [\_\_\_\_], [\_\_\_\_].

a. Certification that the actual thickness of uncoated sheets used in SSSMRS components including roofing panels, subpurlins, and concealed anchor clips complies with specified requirements.

b. Certification that materials used in the installation are mill certified.

c. Previous certification of SSSMR system tested under the Corps of Engineers' Standard Test Method in lieu of ASTM E 1592 testing.

d. Certification that the sheets to be furnished are produced under a continuing quality control program and that a representative sample consisting of not less than three pieces has been tested and has met the quality standards specified for factory color finish.

e. Certification of installer. Installer certification shall be furnished.

f. Warranty certificate. At the completion of the project the Contractor shall furnish signed copies of the 5-year Warranty for Structural Standing Seam Metal Roof (SSSMR) System, a sample copy of which is attached to this section, [and] the 20-year Manufacturer's Material Warranties, [and the manufacturer's 20-year system weathertightness warranty].

Insulation; [\_\_\_\_], [\_\_\_\_].

Certificate attesting that the polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with

weathertight coverings and kept dry. Storage conditions shall provide good air circulation and protection from surface staining.

## 1.7 WARRANTIES

The SSSMR system shall be warranted as outlined below. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

### 1.7.1 Contractor's Weathertightness Warranty

The SSSMR system shall be warranted by the Contractor on a no penal sum basis for a period of five years against material and workmanship deficiencies; system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The SSSMR system covered under this warranty shall include the entire roofing system including, but not limited to, the standing seam metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with ASTM E 1592. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, and skylights; interior or exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system; and items specified in other sections of these specifications that are part of the SSSMR system. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to specified design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's required warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and system manufacturer, which shall be submitted along with Contractor's warranty; however, the Contractor shall be ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached WARRANTY FOR STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM, and shall start upon final acceptance of the facility. It is required that the Contractor provide a separate bond in an amount equal to the installed total roofing system cost in favor of the owner (Government) covering the Contractor's warranty responsibilities effective throughout the five year Contractor's warranty period for the entire SSSMR system as outlined above.

### 1.7.2 Manufacturer's Material Warranties.

The Contractor shall furnish, in writing, the following manufacturer's material warranties which cover all SSSMR system components such as roof panels, anchor clips and fasteners, flashing, accessories, and trim, fabricated from coil material:

a. A manufacturer's 20 year material warranty warranting that the aluminum, zinc-coated steel, aluminum-zinc alloy coated steel or aluminum-coated steel as specified herein will not rupture, structurally fail, fracture, deteriorate, or become perforated under normal design atmospheric conditions and service design loads. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured, perforated, or structurally failed coil material.

b. A manufacturer's 20 year exterior material finish warranty on the factory colored finish warranting that the finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of eight, as determined by ASTM D 4214 test procedures; or change color in excess of five CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to refinishing with an air-drying version of the specified finish or replacing the defective coated material.

c. A roofing system manufacturer's 20 year, non-prorated, system weathertightness warranty.

## 1.8 COORDINATION MEETING

A coordination meeting shall be held 30 days prior to the first submittal, for mutual understanding of the Structural Standing Seam Metal Roof (SSSMR) System contract requirements. This meeting shall take place at the building site and shall include representatives from the Contractor, the roof system manufacturer, the roofing supplier, the erector, the SSSMR design engineer of record, and the Contracting Officer. All items required by paragraph SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall coordinate time and arrangements for the meeting.

## PART 2 PRODUCTS

### 2.1 ROOF PANELS

Panels shall be [steel] [aluminum] and shall have a [factory color] [mill] finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope for slope lengths that do not exceed 9 m. When length of run exceeds 9 m and panel laps are provided, each sheet in the run shall extend over three or more supports. Sheets longer than 30 m may be furnished if approved by the Contracting Officer. Width of sheets shall provide not more than 600 mm of coverage in place. SSSMR system with roofing panels greater than 300 mm in width shall have standing seams rolled during installation by an electrically driven seaming machine. Height of standing seams shall be not less than [\_\_\_\_\_] mm for rolled seam and [\_\_\_\_\_] mm for seams that are not rolled.

#### 2.1.1 Steel Panels

Steel panels shall be zinc-coated steel conforming to ASTM A 653/A 653M; aluminum-zinc alloy coated steel conforming to ASTM A 792/A 792M, AZ [55] [50] coating; or aluminum-coated steel conforming to ASTM A 463/A 463M, Type 2, coating designation T2 65. Uncoated panels shall be 0.024-inch (0.61 mm) thick minimum, except that areas of the roof subject to design wind uplift pressures of 60 psf (2.87 kPa) or greater shall have a minimum panel thickness of 0.030-inch (0.76 mm)." Panels shall be within 95 percent of reported tested thickness as noted in wind uplift resistance testing required in paragraph PERFORMANCE REQUIREMENTS. Prior to shipment, mill finish panels shall be treated with a passivating chemical to inhibit the formation of oxide corrosion products. Panels that have become wet during shipment and have started to oxidize shall be rejected.

#### 2.1.2 Aluminum Panels

Alloy conforming to ASTM B 209M , temper as required for the forming

operation, minimum 0.8 mm thick.

## 2.2 CONCEALED ANCHOR CLIPS

Concealed anchor clips shall be the same as the tested roofing system. Clip bases shall have factory punched or drilled holes for attachment. Clips shall be made from multiple pieces with the allowance for the total thermal movement required to take place within the clip. Single piece clips may be acceptable when the manufacturer can substantiate that the system can accommodate the thermal cyclic movement under sustained live or snow loads.

## 2.3 ACCESSORIES

Flashing, trim, metal closure strips, caps and similar metal accessories shall be the manufacturer's standard products. Exposed metal accessories shall be finished to match the panels furnished. [Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the panels and shall not absorb or retain water.] [Die cast metal closures shall be installed with double bead tape sealant and fasteners that stitch the panel to a 2 mm preformed backer plate to ensure a positive compression of the tape sealant.] The use of a continuous angle butted to the panel ends to form a closure will not be allowed. Thermal spacer blocks and other thermal barriers shall be submitted for approval

## 2.4 FASTENERS

Fasteners for steel roof panels shall be zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for aluminum roof panels shall be aluminum or corrosion resisting steel. Fasteners for structural connections shall provide both tensile and shear ultimate strengths of not less than 3340 N per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be sealed or have sealed washers on the exterior side of the roof to waterproof the fastener penetration. Washer material shall be compatible with the roofing; have a minimum diameter of 10 mm for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 3 mm thick. Exposed fasteners for factory color finished panels shall be factory finished to match the color of the panels.

### 2.4.1 Screws

Screws for attaching anchor devices shall be not less than No. 14 self-tapping type and not less than No. 12 if self-drilling and self-tapping type. Actual screw pull out test results shall be performed for the actual material gage and yield strength of the structural purlins or subpurlins to which the clip is to be anchored/attached. Other screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.

### 2.4.2 Bolts

Bolts shall be not less than 6 mm diameter, shouldered or plain shank as required, with locking washers and nuts.

### 2.4.3 Structural Blind Fasteners

Blind screw-type expandable fasteners shall be not less than 6 mm diameter. Blind (pop) rivets shall be not less than 7 mm minimum diameter.

## 2.5 SUBPURLINS

Cold formed subpurlins , when required by the system design, shall be formed from steel sheet as standard with the manufacturer. The uncoated thickness may be a minimum of 0.059 inches (1.50 mm) if bolts or structural blind fasteners are used for attachment of the concealed anchor clips to the subpurlins and attachment of the subpurlins to the structure. If screws are used for either attachment, then the minimum uncoated thickness of the subpurlin shall be 0.074 inches (1.85 mm). Cold formed subpurlins shall have a minimum tensile yield strength of 50,000 psi (345 MPa). Hot rolled structural members shall have a minimum thickness of 6 mm and a minimum tensile yield strength of 248 MPa. Subpurlins shall be shop painted.

## 2.6 FACTORY COLOR FINISH

Panels shall have a factory applied [polyvinylidene fluoride] [\_\_\_\_\_] finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match the color indicated [on the drawings] [in Section 09915 COLOR SCHEDULE]. The exterior coating shall be a nominal [0.025] [0.050] mm thickness consisting of a topcoat of not less than 0.018 mm dry film thickness and the paint manufacturer's recommended primer of not less than [0.005] [0.025] mm thickness. The interior color finish shall consist of [the same coating and dry film thickness as the exterior] [a nominal 0.025 mm thick [PVF2] [\_\_\_\_\_] finish otherwise the same as the exterior] [a backer coat with a dry film thickness of 0.013 mm ] [a 0.005 mm thick prime coat]. The exterior color finish shall meet the test requirements specified below.

### 2.6.1 Salt Spray Test

A sample of the sheets shall withstand a cyclic corrosion test for a minimum of 2016 hours in accordance with ASTM D 5894, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 10, no blistering, as determined by ASTM D 714; 10, no rusting, as determined by ASTM D 610; and a rating of 6, over 2.0 to 3.0 mm failure at scribe, as determined by ASTM D 1654.

### 2.6.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 3 mm diameter mandrel, the coating film shall show no evidence of cracking to the naked eye.

### 2.6.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in accordance with ASTM G 154, test condition [UVA-340 lamp, 4h UV at 60 degrees C followed by 4h CON at 50 degrees C] [UVA-340 lamp, 8h UV at 60 degrees C followed by 4h CON at 45 degrees C] for [\_\_\_\_\_] total hours. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating with an adhesion rating less than 4B when tested in accordance with ASTM D

3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference ( $\Delta E$ ) units in accordance with ASTM D 2244. For sheets required to have a low gloss finish, the chalk rating shall be not less than No. 6 and the color difference shall be not greater than 7 units.

#### 2.6.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

#### 2.6.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 13 mm diameter hemispherical head indenter, equal to 6.7 times the metal thickness in mm, expressed in Newton-meters, with no cracking.

#### 2.6.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of [50] [80] liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

#### 2.6.7 Specular Gloss

Finished roof surfaces for [\_\_\_\_\_] shall have a specular gloss value of [10 or less at an angle of 85 degrees] [30 plus or minus [\_\_\_\_\_] at 60 degrees] when measured in accordance with ASTM D 523.

#### 2.6.8 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

### 2.7 INSULATION

Thermal resistance of roof insulation shall be R-30. R-values shall be determined at a mean temperature of 24 degrees C in accordance with ASTM C 518. Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Insulation, including facings, shall have a flame spread not in excess of 9 and a smoke developed rating not in excess of 50 when tested in accordance with ASTM E 84. The stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests are conducted in the insulation manufacturer's laboratory. Contractor shall comply with EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

#### 2.7.1 Polyisocyanurate Rigid Board Insulation for Use Above a Roof Deck

Polyisocyanurate insulation shall conform to ASTM C 1289, Type II, (having

a minimum recovered material content of 9 percent by weight of core material in the polyisocyanurate portion). For impermeable faced polyisocyanurate, the maximum design R-value per 25 mm of insulation used shall be 6.0. Facings shall be non-asphaltic, glass fiber reinforced.

#### 2.7.2 Blanket Insulation

Blanket insulation shall conform to ASTM C 991.

#### 2.8 INSULATION RETAINERS

Insulation retainers shall be type, size, and design necessary to adequately hold the insulation and to provide a neat appearance. Metallic retaining members shall be nonferrous or have a nonferrous coating. Nonmetallic retaining members, including adhesives used in conjunction with mechanical retainers or at insulation seams, shall have a fire resistance classification not less than that permitted for the insulation.

#### 2.9 SEALANT

Sealants shall be elastomeric type containing no oil or asphalt. Exposed sealant shall be [colored to match the applicable building color] [clear] and shall cure to a rubberlike consistency. Sealant placed in the roof panel standing seam ribs shall be provided in accordance with the manufacturer's recommendations.

#### 2.10 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be nonrunning after drying.

#### 2.11 VAPOR RETARDER

##### 2.11.1 Not Used

##### 2.11.2 Vapor Retarders Separate from Insulation

Vapor retarder material shall be polyethylene sheeting conforming to ASTM D 4397. A single ply of 0.25 mm polyethylene sheet; or, at the Contractor's option, a double ply of 0.15 mm polyethylene sheet shall be used. A fully compatible polyethylene tape which has equal or better water vapor control characteristics than the vapor retarder material shall be provided. A cloth industrial duct tape in a utility grade shall also be provided to use as needed to protect the vapor retarder from puncturing.

##### 2.11.3 Slip Sheet for Use With Vapor Retarder

Slip sheet for use with vapor retarder shall be a 0.24 kg per square meter rosin-sized, unsaturated building paper.

#### 2.12 EPDM RUBBER BOOTS

Flashing devices around pipe penetrations shall be flexible, one-piece devices molded from weather-resistant EPDM rubber. Rubber boot material shall be as recommended by the manufacturer. The boots shall have base rings made of aluminum or corrosion resisting steel that conform to the contours of the roof panel to form a weather-tight seal.

## 2.13 PREFABRICATED CURBS AND EQUIPMENT SUPPORTS

Prefabricated curbs and equipment supports shall be of structural quality, hot-dipped galvanized or galvanized sheet steel, factory primed and prepared for painting with mitered and welded joints. Integral base plates and water diverter crickets shall be provided. Minimum height of curb shall be 200 mm above finish roof. Curbs shall be constructed to match roof slope and to provide a level top surface for mounting of equipment. Curb flange shall be constructed to match configuration of roof panels. Curb size shall be coordinated, prior to curb fabrication, with the mechanical equipment to be supported. Strength requirements for equipment supports shall be coordinated to include all anticipated loads. Flashings shall not be rigidly attached to underline structure.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated by means of gaskets or insulating compounds. Molded closure strips shall be installed wherever roofing sheets terminate in open-end configurations, exclusive of flashings. The closure strip installation shall be weather-tight and sealed. Screws shall be installed with a clutching screw gun, to assure screws are not stripped. Field test shall be conducted on each gun prior to starting installation and periodically thereafter to assure it is adjusted properly to install particular type and size of screw as recommended by manufacturer's literature. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

#### 3.1.1 Field Forming of Panels for Unique Area

When roofing panels are formed from factory-color-finished steel coils at the project site, the same care and quality control measures that are taken in shop forming of roofing panels shall be observed. Rollformer shall be operated by the metal roofing manufacturer's representative. In cold weather conditions, preheating of the steel coils to be field formed shall be performed as necessary just prior to the rolling operations.

#### 3.1.2 Subpurlins

Unless otherwise shown, subpurlins shall be anchored to the purlins or other structural framing members with bolts or screws. Attachment to the substrate (when provided) or to the panels is not permitted. The subpurlin spacing shall not exceed 750 mm on centers at the corner, edge and ridge zones, and 1500 mm maximum on centers for the remainder of the roof. Corner, edge, and ridge zones are as defined in ASCE 7. Closer spacing may be required by the roofing manufacturer to meet the roof uplift loads calculated and submitted with the shop drawings.

#### 3.1.3 Roof Panel Installation

Roof panels shall be installed with the standing seams in the direction of

the roof slope. The side seam connections for installed panels shall be completed at the end of each day's work. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weather-tight installation. End laps of panels shall be provided in accordance with the manufacturer's instructions. Closures, flashings, EPDM rubber boots, roof curbs, and related accessories shall be installed according to the manufacturer's drawings. Fasteners shall not puncture roofing sheets except as provided for in the manufacturer's instructions for erection and installation. Expansion joints for the standing seam roof system shall be installed at locations indicated on the contract drawings and other locations indicated on the manufacturer's drawings.

#### 3.1.4 Concealed Anchor Clips

Roof panels shall be fastened to framing members with concealed fastening clips or other concealed devices. Clips shall be attached directly to the building structural system or to the subpurlins with bolts or screws. Attachment to the substrate (when provided) or to the metal deck is not permitted. The maximum distance, parallel to the seams, between clips shall be 750 mm on center at the corner, edge, and ridge zones, and 1500 mm maximum on centers for the remainder of the roof. Closer spacing may be required by the roofing manufacturer to meet the roof uplift pressures calculated and submitted with the shop drawings. Attachment of clips through rigid insulation to structure is prohibited.

### 3.2 INSULATION INSTALLATION

Insulation shall be continuous over entire roof surface. Where expansion joints, terminations, and other connections are made, the cavity shall be filled with batt insulation with vapor retarder providing equivalent R-value and perm rating as remaining insulation. Insulation shall be installed as indicated and in accordance with manufacturer's instructions.

#### 3.2.1 Board Insulation with Blanket Insulation

Rigid or semirigid board insulation shall be laid in close contact. Board shall be attached to the metal roof deck with bearing plates and fasteners, as recommended by the insulation manufacturer, so that the insulation joints are held tight against each other, and shall have a minimum of 1 fastener per 0.37 square meters. Layout and joint pattern of insulation and fasteners shall be indicated on the shop drawings. If more than one layer of insulation is required, joints in the second layer shall be offset from joints in the first layer. A layer of blanket insulation shall be placed over the rigid or semirigid board insulation to be compressed against the underside of the metal roofing to reduce thermal bridging, dampen noise, and prevent roofing flutter. This layer of blanket insulation shall be compressed a minimum of 50 percent. Thermal blocks shall not be placed in between the concealed anchor clips and the subpurlins or supporting structure.

#### 3.2.2 Blanket Insulation

Blanket insulation shall be installed between and parallel to the purlins with tabs of a facer lapping on the top face of the purlins. Thermal blocks shall be provided over purlins, between clips. A second layer of unfaced insulation shall be added between purlins to provide full R-value. Blanket insulation shall be supported by an integral facing or other commercially available support system.

### 3.3 PROTECTION OF VAPOR RETARDER FROM ROOF DECK

A cloth industrial duct tape shall be applied over the seams of metal roof decks, at penetration edges, and at surface areas exhibiting sharp burrs or similar protrusions. For other types of roof decks, cloth industrial duct tape shall be applied over irregularities which could potentially puncture polyethylene membrane.

### 3.4 VAPOR RETARDER INSTALLATION

#### 3.4.1 Integral Facing on Blanket Insulation

Integral facing on blanket insulation shall have the facing lapped and sealed with a compatible tape to provide a vapor tight membrane.

#### 3.4.2 Polyethylene Vapor Retarder

The polyethylene vapor retarder membrane shall be installed over the entire surface. A fully compatible polyethylene tape shall be used to seal the edges of the sheets to provide a vapor tight membrane. Sheet edges shall be lapped not less than 150 mm. Sufficient material shall be provided to avoid inducing stresses in the sheets due to stretching or binding. All tears or punctures that are visible in the finished surface at any time during the construction process shall be sealed with polyethylene tape.

### 3.5 SLIP SHEET INSTALLATION

A slip sheet shall be laid over the blanket insulation facing to prevent the vinyl facing from adhering to the metal roofing.

### 3.6 CLEANING AND TOUCH-UP

Exposed SSSMR systems shall be cleaned at completion of installation. Debris that could cause discoloration and harm to the panels, flashings, closures and other accessories shall be removed. Grease and oil films, excess sealants, and handling marks shall be removed and the work shall be scrubbed clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks. Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Factory color finished surfaces shall be touched up with the manufacturer's recommended touch up paint.

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

FACILITY DESCRIPTION \_\_\_\_\_

BUILDING NUMBER: \_\_\_\_\_

CORPS OF ENGINEERS CONTRACT NUMBER: \_\_\_\_\_

CONTRACTOR

CONTRACTOR: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

OWNER

OWNER: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

CONSTRUCTION AGENT

CONSTRUCTION AGENT: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_

TELEPHONE NUMBER: \_\_\_\_\_

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM  
(continued)

THE SSSMR SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY \_\_\_\_\_ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE. THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: THE ENTIRE ROOFING SYSTEM, MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH ASTM E 1592. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHINGS INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE SSSMR SYSTEM.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE ASSOCIATED WITH THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON \_\_\_\_\_ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

\_\_\_\_\_  
(Company President) (Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM  
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE SSSMR SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE SSSMR SYSTEM DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. CONTRACTOR'S DESIGN SHALL INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.
6. THIS WARRANTY APPLIES TO THE SSSMR SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR; AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

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CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM  
(continued)

\*\*REPORTS OF LEAKS AND SSSMR SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE, BY TELEPHONE OR IN WRITING, FROM EITHER THE OWNER OR CONTRACTING OFFICER. EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS SSSMR SYSTEM WITHIN SEVEN (7) CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE SSSMR SYSTEM REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED, THE PARTIES SHALL, WITHIN TEN (10) DAYS, JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN TEN (10) DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE (1) NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED, ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

DIVISION 8 – DOORS AND WINDOWS

08000

Division 8: Doors And Windows - Outline Specifications



acceptable. Reinforcing of door assemblies for closers and other required hardware shall be in accordance with ANSI A250.8 and the conditions of the fire door assembly listing when applicable.

Exterior doors shall have top edges closed flush and sealed against water penetration. Exterior doors shall be thermal insulated doors and shall have a minimum insulation value of  $R_{si}=1.76$  ( $R=10$ ). The interior of thermal insulated doors shall be filled with rigid plastic foam permanently bonded to each face panel. Paint color for steel doors and frames to match Fed Std 595b, No x0099. Manufacturer: Republic Door Company or equal.

#### 1.3.2 Interior Hollow metal Window Frames

Interior Hollow metal window frames shall be constructed in accordance with HMMA-820. Frames shall be 16 ga. All interior glazing shall be Laminated Glass in accordance with specification section 08810, Glass and Glazing. Paint color for interior window frames will be as directed by the Contracting Officer.

#### 1.4 SECTION 08120, ALUMINUM DOORS AND FRAMES

Doors: 1-3/4 inch x 3-3/4 inch nominal medium stile entrance doors with mortised and reinforced comer construction equal to Amarlite "73."  
Framing System: 2 inch x 4-1/2" framing members with flush glazing and clear sight lines equal to Amarlite "Weatherseal" entrance framing system. Finish to be Kawneer #40 dark bronze anodized or equal.

#### 1.5 SECTION 08210, WOOD DOORS

##### 1.5.1 Flush Wood Doors

Flush wood doors shall be solid core and shall conform to NWWDA I.S. 1-A. Wood doors shall be 5-ply or 7-ply construction with faces, stiles, and rails bonded to the core

##### 1.5.2 Wood Veneer

Veneer doors shall be Premium Grade plain sawn, book matched, red oak veneer in accordance with NWWDA I.S. 1-A. Vertical stile strips shall be selected to provide edges of same species and/or color as the face veneer.

##### 1.5.3 Finish

Doors shall receive factory coated stain finish and shall be given a transparent finish conforming to AWI-02, Section 1500, Premium Grade, light stain, medium rubbed sheen, close grain effect. Finish shall be AWI factory finish system Number TR3 or TR4. Edges of unfitted doors shall be field finished after fitting to the frames.

##### 1.6 Not Used

##### 1.7 Not Used

#### 1.7 SECTION 08360, SECTIONAL OVERHEAD DOORS

##### 1.7.1 Doors

Doors and components shall be designed to withstand wind loads determined by procedures in ASCE 7 and a wind speed of 40m/s. Doors shall be

constructed to sustain a superimposed load, both inward and outward, equal to 1-1/2 times the minimum design wind load. The door shall support the superimposed loads for a minimum period of 10 seconds without evidence of serious damage and shall be operable after conclusion of the tests. Doors shall be equipped with torsion springs designed to operate through a minimum of 100,000 cycles. One complete cycle of the door begins with the door in the closed position. The door is then moved to the open position and back to the closed position. Steel Doors: Door sections shall be single skin with integral joint, and shall be formed of hot-dipped galvanized steel. Panels shall be constructed of galvanized steel not lighter than 16 ga. with flush surface or 20 ga. with longitudinal integral reinforcing ribs or 24 ga. with longitudinal integral reinforcing ribs and flat bottom V-grooves. Door sections shall be insulated with a minimum R=11 and 26-gauge steel back cover. Door sections will have double thermopane windows as indicated on the attached elevations.

#### 1.7.2 Tracks

Tracks shall be the manufacturer's standard 3 inch equipped with spring stops

#### 1.7.3 Finish

Steel surfaces shall be hot-dip galvanized G60 in accordance with ASTM A 653/A 653M, and shall be treated for paint adhesion and shall receive a baked on prime coat and a baked on factory finish coat. The paint system shall withstand a minimum of 1500 hours salt spray test in accordance with ASTM B 117 without blistering, bubbling, or rust. Color to match Fed Std 595b, No. x0099.

#### 1.7.4 Operator

Doors shall be operated by means of electric power with auxiliary chain hoist. Electric power operators shall be heavy-duty industrial type. The unit shall operate the door through the operational cycle life specified. The electric power operator shall be complete with electric motor, auxiliary operation, necessary means of reduction, magnetic brake, brackets, push button controls, limit switches, magnetic reversing starter, and other accessories necessary to operate. Trolley type operators shall be used on standard lift and low headroom tracks.

#### 1.7.5 Weatherstripping

Exterior doors shall be provided with weatherproof joints between sections. Head and jambs shall be provided with rubber or vinyl bulb or leaf type weatherstripping, or with nylon-brush type weatherstripping. Bottom of door shall be provided with a compressible neoprene, rubber, or vinyl weather seal. Weatherstripping shall be adjustable. Weatherstripping shall be specifically designed for use with overhead doors. On electric power operated doors, the bottom seal shall be a combination weather seal and sensing edge

### 1.8 SECTION 08520, ALUMINUM AND ENVIRONMENTAL CONTROL ALUMINUM WINDOWS

All exterior windows shall be outswing casement type windows with insulated, low E glass. Refer to specification section 08810, Glass and Glazing, for additional requirements. Contractor will provide Kawneer Sealair Architectural Windows, GLASSvent series, outswing casement, or equal

### 1.8.1 Frames

All units shall have a thermal break in the frame and meet ANSI/AAMA A3 designation for design and performance criteria

### 1.8.2 Insect Screens

All operable windows shall come complete with insect screens. Frames for screens shall match the window frame color and material.

### 1.8.3 Finish

Aluminum Finish: Anodized, NAAMM AA-C22A44, Kawneer #40 dark bronze or equal.

## 1.9 SECTION 08700, BUILDERS' HARDWARE

All door hardware shall meet the requirements of Builders Hardware manufacturers association (BHMA)

### 1.9.1 Hinges

Hinges shall conform to BHMA A156.1. Hinges used on metal doors and frames shall also conform to BHMA A156.7. Hinges shall be grade 1, finish 652 on all interior doors except the main entry vestibule which shall be grade 1, finish dark bronze 624. All exterior doors shall have grade 1 stainless steel with a brushed finish, with the exception of the main entry aluminum doors, which shall be grade 1, finish dark bronze 624. Hinges shall be full mortise 4 ½ x 4 ½ inches.

### 1.9.2 Lock and latchsets

Lock and latchsets shall be Bored lock, latchsets, series 4000 and shall conform to BHMA A156.2, Grade 1. Bored type locks and latches for doors 1-3/8 inch thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door. Finish shall be brushed satin chrome 652

### 1.9.3 Closers

Surface type closers shall be Grade 1, C02000 Standard Cover with options PT?4H, Size 1 or 2 through Size 6, and PT-4D with back check position valve. For exterior doors, closers shall be size V for doors less than 914 mm wide, and size VI for doors 914 mm wide and wider. Except as otherwise specified, sizes shall conform to the manufacturer's published recommendations. Closers for outswinging exterior doors shall have parallel arms or shall be top jamb mounted and be thru bolted. Closers for doors close to a wall shall be of narrow projection so as not to strike the wall at the 90 degree open position. Surface type closers shall be the product of one manufacturer only. Closers shall be thru bolted on all wood doors and all exterior doors.

### 1.9.4 Exit Devices

Exit Devices shall be modern style touch bar, grade 1 with a 652 finish

## 1.10 SECTION 08810, GLASS AND GLAZING

## 1.10.1 Wire Glass

Polished wire glass: clear, Type II, Class 1, Form 1, Mesh MI (welded diamond), UL labeled, nominal 1/4 inch thick

## 1.10.2 Insulating glass

Insulating glass: 1 inch overall thickness consisting of two layers 1/4 inch glass separated by a dehydrated 1/2 inch continuous airspace and hermetically sealed. The exterior lite shall be bronze tint. The interior lite shall be a clear laminated glass. Insulated units shall meet ASTM E774 - Sealed Insulating Glass Units, visible light transmittance of 46 percent to 47 percent, summer daytime U-value of 0.56 to 0.57, winter nighttime U-value of 0.49, shading coefficient of 0.56 to 0.58, and outdoor reflectance of 8 percent

## 1.10.3 Laminated Glass

Fabricated from two pieces of fully tempered, Condition A (uncoated), Type I, Class 1 (transparent), Quality q3, glass laminated together with a clear thick polyvinyl butyral interlayer. The total thickness shall be nominally .

## 1.10.4 Mirrors

Mirrors in restrooms and locker areas shall be laminated tempered glass in stainless steel frames. Width of individual mirrors shall be as follows: Bathroom lavatories - 48 inch height x width of countertop with thickness in proportion to the surface area; Locker areas - 48 inches wide x 72 inches high, with thickness in proportion to the surface area.

PART 2 Not Used

PART 3 not used

-- End of Section --

DIVISION 9 – FINISHES

09000	Division 9: Finishes - Outline Specifications
09310A	Ceramic Tile
09671	Seamless Resinous Floor System
09672	Conductive Seamless Resinous Floor System
09920	Contractor Color Boards

0

## SECTION 09000

DIVISION 9: FINISHES - OUTLINE SPECIFICATIONS  
01/02

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

## 1.1.1 Contractor Edited Guide Specifications

The contractor shall edit and provide the following UFGS guide specifications for Division 9: Finishes:

Section 09250A, GYPSUM WALLBOARD

Section 09510A, ACOUSTICAL CEILINGS

Section 09650A, RESILIENT FLOORING

Section 09680A, CARPET

Section 09900A, PAINT, GENERAL

## 1.1.2 Government Edited Specifications

The contractor shall incorporate the following government-supplied, fully edited specification sections as part of the project design:

Section 09310A, CERAMIC TILE

Section 09670A, SEAMLESS RESINOUS FLOORING

Section 09920, CONTRACTOR COLORBOARDS

## 1.2 REFERENCES

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 36/C 36M	(1999) Gypsum Wallboard
ASTM C423-84a	Sound Absorption Coefficients by Reverberation Room Method
ASTM C 630/C 630M	(2000) Water-Resistant Gypsum Backing Board
ASTM C 635	(1995) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM E84	(2000a) Surface Burning Characteristics of Building Materials
ASTM E 1264	(1990) Standard Classification for Acoustical Ceiling Products

ASTM F793	Standard Classification of Wallcoverings by Durability Characteristics
ASTM F 1066	(1995a) Vinyl Composition Floor Tile
ASTM F 1861	(1998) Standard Specification for Resilient Wall Base

CHEMICAL FABRIC AND FILM ASSOCIATION

CFFA-W-101-B	(1995) CFFA Quality Standard for Vinyl Coated Fabric Wallcovering
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1.3 SECTION 09250, GYPSUM WALLBOARD

The contractor edited specification section shall include the following material physical characteristics and performance criteria for gypsum wallboard:

1.3.1 General Requirements

Gypsum wallboard shall be min. thickness, wide and shall be maximum permissible height. Provide work with fire resistance ratings conforming to assemblies tested and listed by recognized authorities.

1.3.2 Metal Studs

All metal studs shall be min. thickness. In addition the contractor shall design the interior partition framing and furring system to be capable of carrying a transverse load of without exceeding either the allowable stress or a deflection of L/240. Ceiling framing for gypsum drywall ceilings shall be a maximum of .

1.3.3 Standard Gypsum Wallboard

Regular gypsum board shall conform to ASTM C 36/C 36M, and shall be wide.

1.3.4 Fire-Rated Gypsum Wallboard

Fire-rated gypsum board shall conform to ASTM C 36/C 36M, and shall be Type X or Type C as required, wide.

1.3.5 Moisture-Resistant Gypsum Wallboard

Water-resistant gypsum board shall conform to ASTM C 630/C 630M, regular and Type X, with water-resistant paper faces, paintable surfaces, and shall be width and maximum permissible length.

1.3.6 Impact Resistant (Reinforced) Gypsum Wallboard

Impact resistant, reinforced gypsum board shall have a minimum indentation resistance of at or at and a minimum penetration resistant rating of for a thick sheet of gypsum board.

1.4 SECTION 09510A, ACOUSTICAL CEILINGS

1.4.1 Material Criteria

The contractor edited specification section shall include the following material physical characteristics and performance criteria for acoustical ceilings:

- A. All acoustical ceiling panels shall utilize an exposed grid suspension system.
- B. Standard Ceiling Panels: Shall be similar in shape, edge detail, and surface pattern to US Gypsum Acoustone "Frost", panel no. 414, FL shadowline bevel edge. Panel shall be foil-backed to resist moisture and assist in sound deadening. Color of all ceiling panels shall be integral throughout the unit. Edge profile for all panels shall be tegular to provide a recessed lip for grid location. Minimum NRC rating for all panels shall be .65. Acoustical units shall conform to ASTM E 1264, Class A. Panels shall be x x thick.
- C. High Abuse Ceiling Panels: Shall be similar in shape, edge detail, and surface pattern to US Gypsum Acoustone "Radar Ceramic/ClimaPlus", panel no. 56644, SQ square edge profile. Panel composition shall be 100% ceramic-bonded mineral fiber to withstand high heat, high humidity, and corrosive chemical fumes. Minimum NRC rating for all panels shall be .50. Acoustical units shall conform to ASTM E 1264, Class A. Panels shall be x x thick.
- D. Ceiling Grid: Grid for all suspended acoustical ceilings shall be an exposed standard width system. Suspension systems shall conform to ASTM C 635 for intermediate-duty systems. Suspended ceiling framing system shall have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. The suspension system shall have a maximum deflection of 1/360 of span length. Seismic work shall be coordinated with ceiling electrical work. A standard wide flange, exposed grid suspension system shall be used where indicated on the drawings. Wall molding shall have a flange of not less than . System shall consist of a double web steel tee and cap with corrosion resistant coating.
- 1) Surfaces exposed to view for standard ceiling panels shall be steel with a factory-applied color baked-enamel finish. Outside corner caps shall be provided.
  - 2) Grid for vinyl-faced panels shall be hot-dipped, galvanized with aluminum cap suitable for food processing areas and meeting USDA/FSIS requirements.

## 1.5 SECTION 09650A, RESILIENT FLOORING

### 1.5.1 Material Criteria

The contractor edited specification section shall include the following material physical characteristics and performance criteria for resilient flooring materials:

- B. Rubber Base: Rubber wall base shall be Type TS, thermoset vulcanized extruded type and shall conform to ASTM F 1861, Group 1 (solid). All rubber wall base shall be high and a minimum thickness of . All rubber wall base shall be a manufacturer's standard product in a straight or coved profile, and in locations as indicated in the space data sheets. No pre-formed outside corners shall be allowed.

Rubber wall base shall be provided in continuous roll form ( coil) to minimize seaming. Factory-cut lengths are not allowed.

C. Flooring Transition Strips: Solid rubber or vinyl transition strip moldings shall be provided at all locations where dissimilar flooring materials meet, including doorways. Profiles shall be of widths, thickness, undercuts, butting edges, and profile types suitable to provide a smooth, safe transition between dissimilar floor finish materials. Colors shall be as indicated in the Interior Finish Materials Legend on the drawings. Submittals are required for this item.

#### 1.5.2 Installation Criteria

The contractor edited specification section shall include the following installation criteria for wall base:

A. Wall base corners shall not be separate preformed components. Inside and outside corners shall be formed from roll goods utilizing a scribing method as recommended by the wall base manufacturer to provide a continuous one-piece appearance at all corners.

#### 1.6 SECTION 09680A, CARPET

##### 1.6.1 Physical Characteristics

The contractor edited specification section shall include the following material physical characteristics and performance criteria for carpet:

- A. All carpet flooring shall be a patterned carpet tile.
- B. All carpet tile shall be x in size. Carpet construction shall be a tufted, level loop with attached cushion foundation.
- C. Pile fiber shall be a branded 100 percent solution-dyed nylon or a blend of 75 percent branded solution-dyed nylon and 25 percent branded type 6,6 nylon.
- D. Finished pile yarn weight shall be a minimum of .
- E. Pile density factor shall be a minimum of 20-6154.
- F. Cushion backing shall be an attached fiberglass reinforced composite, closed-cell vinyl with a pre-applied "tackifier" consisting of a factory-applied, full spread adhesive.

#### 1.7 SECTION 09900A, PAINT

##### 1.7.1 Physical Characteristics

The contractor edited specification section shall include the following material physical characteristics and performance criteria for paint products:

- A. Interior Latex Paint: Gloss level for walls shall be eggshell. Gloss level for ceilings shall be flat. Solids content shall be a minimum of 35 percent.
- B. Interior Alkyd Enamel: Shall be used on all metal door and window

frames. Gloss level shall be semigloss. Solids content shall be a minimum of 40 percent.

C. Dryfall Paint: Dryfall paint specified for interior ceilings and overhead surfaces such as steel joists, support steel, galvanized structural components shall be a single coat, fast drying, high reflective Galvite epoxy ester paint equal in performance characteristics, specifications, and application to SHERWIN-WILLIAMS COMPANY product no. B-48 W602. Product shall fall dry in ten feet under normal environmental conditions (25 degrees C, 50% RH).

D. Interior Wood Stain: Transparent type interior wood wiping stain shall be formulated from manufacturer's first quality standard colors in combination with specified wood species, graining, and finish system to match the finish indicated in the drawing Interior Finish Materials Legend and shown on the project colorboards.

E. Interior Wood Polyurethane Finish: Interior polyurethane varnish shall be a waterborne, one component, moisture-curing clear finish selected from manufacturer's first quality standard product line.

F. Interior Epoxy Wall Paint: Epoxy paint scheduled for interior wall surfaces, including work bays, shall be a VOC compliant, two-package, epoxy-polyamide coating equal in physical properties, performance characteristics, specifications, and application to SHERWIN-WILLIAMS COMPANY product no. B-62Z-100 Series Tile-Clad High Solids Epoxy.

#### 1.7.2 Application Criteria and Requirements

The contractor edited specification section shall include the following application criteria:

##### A. Transparent Stained Wood:

1) Surface Preparation: Interior wood surfaces to receive transparent stain shall be sanded. Birch, oak, and other open-grain wood to receive stain shall be given a coat of wood filler not less than 8 hours before the application of stain; excess filler shall be removed and the surface sanded smooth.

2) Interior Stain: Interior transparent stains shall be applied to wood surfaces in accordance with stain manufacturer's recommendations including sanding and drying time between coats and before polyurethane is applied. Number of coats shall be dependant on wood species, stain opacity, absorption rate, and required appearance.

3) Polyurethane: Polyurethane shall be applied to stained wood in accordance with the manufacturer's instructions and recommendations for application, curing, sanding, and drying time between coats. The total coating system shall not be less than 2 mils in uniform thickness.

C. Surfaces To Be Painted: The following factory primed, or factory finished surfaces shall be specifically listed to be painted to match the surface on which they appear:

1) Recessed light fixture trim rings.

- 2) Supply and return air grills and covers.
- 3) Fire alarm bells and housings, fire warning strobe light housings.
- 4) Fire extinguisher cabinets and frames.
- 5) All wall and ceiling access doors and frames on finished surfaces.
- 6) Convector covers and heating unit enclosures.
- 7) Electrical/breaker box panel doors and frames.

C. Painting Schedules: An exterior and interior painting schedule shall be provided at the end of the specification section using the format provided in the USFG Guide Specification. A schedule should be supplied for each paint type in combination with each substrate to be painted.

-- End of Section --

## SECTION 09310A

CERAMIC TILE  
09/01

## 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 basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.1A	(1992) Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar
ANSI A108.1B	(1992) Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar
ANSI A108.4	(1992) Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive
ANSI A108.5	(1992) Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
ANSI A108.6	(1992) Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy
ANSI A108.7	(1992) Electrically Conductive Ceramic Tile Installed with Conductive Dry-Set Portland Cement Mortar
ANSI A108.8	(1992) Installation of Ceramic Tile with Chemical Resistant Furan Mortar and Grout
ANSI A108.10	(1992) Installation of Grout in Tilework
ANSI A118.1	(1992) Dry-Set Portland Cement Mortar
ANSI A118.2	(1992) Conductive Dry-Set Portland Cement Mortar
ANSI A118.3	(1992) Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive
ANSI A118.4	(1992) Latex-Portland Cement Mortar
ANSI A118.5	(1992) Chemical Resistant Furan Mortars and Grouts for Tile

ANSI A118.6 (1992) Ceramic Tile Grouts  
 ANSI A118.9 (1992) Test Methods and Specifications for Cementitious Backer Units  
 ANSI A136.1 (1992) Organic Adhesives for Installation of Ceramic Tile  
 ANSI A137.1 (1988) Ceramic Tile

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185 (1997) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement  
 ASTM C 33 (1999a) Concrete Aggregates  
 ASTM C 144 (1999) Aggregate for Masonry Mortar  
 ASTM C 150 (1999a) Portland Cement  
 ASTM C 206 (1984; R 1997) Finishing Hydrated Lime  
 ASTM C 207 (1991; R 1997) Hydrated Lime for Masonry Purposes  
 ASTM C 241 (1997) Abrasion Resistance of Stone Subjected to Foot Traffic  
 ASTM C 373 (1988; R 1994) Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products  
 ASTM C 648 (1998) Breaking Strength of Ceramic Tile  
 ASTM C 847 (1995) Metal Lath  
 ASTM C 1026 (1987; R 1996) Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling  
 ASTM C 1027 (1999) Determining Visible Abrasion Resistance of Glazed Ceramic Tile  
 ASTM C 1028 (1996) Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method  
 ASTM C 1178/C 1178M (1999) Glass Mat Water-Resistant Gypsum Backing Panel

MARBLE INSTITUTE OF AMERICA (MIA)

MIA Design Manual (1991) Design Manual IV Dimensional Stone

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 99

(1999) Health Care Facilities

TILE COUNCIL OF AMERICA (TCA)

TCA Hdbk

(2000) Handbook for Ceramic Tile  
Installation

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. All items designated with a "G", including product literature, calculations, component data, certificates, diagrams, drawings, and samples shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

## SD-02 Shop Drawings

Floor and Wall Patterns; AE.

Installer's shop drawings showing proposed tile location and patterns. Submittal of duplicated or photocopied project drawing floor tile layouts in lieu of installer produced original shop drawings indicates contractor's full compliance of the tile placement and pattern locations as shown on the project drawings with no variances.

## SD-03 Product Data

Tile; AE  
Mortar, Grout, and Adhesive; AE

Manufacturer's catalog data.

Tile; AE  
Mortar and Grout; AE

Manufacturers preprinted installation and cleaning instructions.

## SD-04 Samples

Tile; AE  
Accessories; AE

Samples of sufficient size to show color range, pattern, type and joints.

## SD-07 Certificates

Tile; FIO  
Mortar, Grout, and Adhesive; FIO

Certificates indicating conformance with specified requirements. A master grade certificate shall be furnished for tile.

### 1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather, and stored under cover in accordance with manufacturer's instructions.

### 1.4 ENVIRONMENTAL REQUIREMENTS

Ceramic tile work shall not be performed unless the substrate and ambient temperature is at least and rising. Temperature shall be maintained above while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used they shall be vented to the outside to avoid carbon dioxide damage to new tilework.

### 1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided.

## PART 2 PRODUCTS

### 2.1 TILE

Tile shall be standard grade conforming to ANSI A137.1. Containers shall be grade sealed. Seals shall be marked to correspond with the marks on the signed master grade certificate. Tile shall be impact resistant with a minimum breaking strength for wall tile of and for floor tile in accordance with ASTM C 648. Tile for cold climate projects shall be rated frost resistant by the manufacturer as determined by ASTM C 1026. Water absorption shall be 0.50 maximum percent in accordance with ASTM C 373. Floor tile shall have a minimum coefficient of friction of 0.50 wet and dry in accordance with ASTM C 1028. Floor tile shall be Class III-Medium Heavy Traffic, durability classification as rated by the manufacturer when tested in accordance with ASTM C 1027 for abrasion resistance as related to foot traffic.

#### 2.1.1 Porcelain Floor Tile (PFT)

All porcelain floor tile shall be by (nominal) typical or by nominal (Ready Room only) in size. All porcelain tile products including floor tile, floor base, and accessories shall be manufactured as standard products from one manufacturer.

##### 2.1.1.1 Porcelain Floor Tile Base (PFTB)

Porcelain floor tile base shall be provided and installed at all locations where porcelain tile flooring occurs and shall match the floor tile field color. Base profile shall be coved. Coved base shall be high by wide (nominal) in size. Coved base shall utilize preformed inside and outside corners at all locations.

#### 2.1.2 Glazed Wall Tile (CWT)

Glazed wall tile and trim shall be cushion edged with a combination of crystalline, bright, or matte finish. Tile shall be (nominal).

### 2.1.3 Porcelain Mosaic Wall Tile (PMWT)

Porcelain mosaic wall tile shall be 76 mm3-inches by 3-inches by 76 mm 5/16-inch (nominal) in size. Manufacturer's trim components designed for a non-mortar, organic adhesive installation method, including bullnose edges, shall be utilized to the maximum extent possible.

#### 2.1.3.1 Porcelain Mosaic Wall Tile Base (PMTB)

Porcelain mosaic wall tile base shall be provided and installed at all locations where porcelain mosaic wall tile flooring and shall match the wall tile color. Base profile shall be coved. Coved base shall be high by wide (nominal) in size. Coved base shall utilize preformed inside and outside corners at all locations.

### 2.2 WATER

Water shall be potable.

### 2.3 MORTAR

Mortar type shall be latex (polymer) modified portland cement. Latex (polymer) additive may be a liquid add mixture similar to TEC #370 "Full Set" with TEC "Extra-Flex" acrylic mortar additive or included as a dry component of the mortar dry mixture similar to TEC "Full Flex.". Mortar shall meet the requirements of ANSI 118.4.

### 2.4 GROUT

#### 2.4.1 Floor Grout

Floor grout shall be latex-modified, sanded grout complying with ANSI 118.6 similar to TEC "Accucolor" TA-650 with TEC #TA-869 acrylic additive. Color shall be as directed by the contracting officer.

#### 2.4.2 Wall Grout

Wall grout shall be latex-modified, unsanded grout complying with ANSI 118.6 similar to TEC "Accucolor" TA-620 with TEC #TA-869 acrylic additive for all ceramic wall tile installation. Wall grout shall be latex-modified, sanded grout complying with ANSI 118.6 similar to TEC "Accucolor" TA-650 with TEC #TA-869 acrylic additive for all porcelain mosaic wall tile installation. Color shall be as directed by the contracting officer.

### 2.5 ORGANIC ADHESIVE

Organic adhesive shall be used to install ceramic wall tile. Organic adhesive shall comply with ANSI A136.1, Type I, for wet areas similar to TEC #122 "Double Duty".

### 2.6 CAULK

Caulk shall be an acrylic latex type, either sanded (similar to TEC #TA-850) or unsanded (similar to TEC #TA-820). Caulk shall match the color and texture (sanded or unsanded)of the adjacent grout.

### 2.7 EQUIPMENT

When installing porcelain floor tile up to in size, the notch trowel used shall be a minimum of . For tile or larger, the notch trowel used shall be . All trowels shall have a rounded profile.

## 2.8 ACCESSORIES

Accessories shall include all extrusions and transition-type items used to provide flexible joints or to transition dissimilar flooring heights or materials. Model numbers provided on the drawings are to indicate type and profile required. Contractor shall verify finished flooring material thicknesses to determine the appropriate model number of each type of transition strip to be used and shall request variances as needed.

### 2.8.1 Metal Moldings and Joint Connectors

Provide and install metal transition strips, flexible joint connectors, and other metal tile accessories in profiles and locations shown in the drawings for floor tile installation on floors.

### 2.8.2 Rubber and Vinyl Transition Strips

Provide and install rubber and vinyl transition floor moldings and strips in types, profiles, and locations as required.

PART 3 EXECUTION

## 3.1 PREPARATORY WORK AND WORKMANSHIP

Surface to receive tile shall be inspected and shall conform to the requirements of ANSI A108.1A or ANSI A108.1B for surface conditions for the type setting bed specified and for workmanship. Variations of surface to be tiled shall fall within maximum values shown below:

## 3.2 GENERAL INSTALLATION REQUIREMENTS

Tile work shall not be started until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Floor tile installation shall not be started in spaces requiring wall tile until after wall tile has been installed. Tile in colors and patterns indicated shall be applied in the area shown on the drawings. Tile shall be installed with the respective surfaces in true even planes to the elevations and grades shown. Special shapes shall be provided as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Tile bases and coves shall be solidly backed with mortar.

### 3.2.1 Tile Patterns

Floor and wall tile patterns shall be provided on floors and walls within rooms indicated on the drawings. Patterns shall be geometric, utilizing whole tiles to the maximum extent possible. Patterns shall incorporate a field tile color with a minimum of 2 additional accent color tiles of a different surface finish to form the pattern.

## 3.3 INSTALLATION OF WALL TILE

Wall tile shall be installed in accordance with the TCA Hdbk, method W242-2K. Wall tile shall be installed in locations as indicated on the drawings to include patterns. Patterns shall be continuous on all wall surfaces within each room where wall tile is installed.

### 3.3.1 Organic Adhesive

Organic adhesive installation of ceramic tile shall conform to ANSI A108.4. Grout size shall not exceed in width.

### 3.3.2 Furan Mortar and Grout

Furan mortar and grout installation shall conform to ANSI A108.8. Grout joint sizes shall not exceed tile manufacturer's recommended size for the type of wall tile and installation method being used.

## 3.4 INSTALLATION OF PORCELAIN FLOOR TILE

### 3.4.1 Mortar Bed

A latex (polymer)-modified portland cement mortar bed shall be used to install tile directly over properly cured, plane, clean concrete slabs. Mortar and floor tile shall be installed in accordance with TCA Hdbk, method F 113-2K and ANSI 108.5.

#### 3.4.1.1 Contraction (Control) Joints

Contraction (control) joints shall be detailed as shown on the drawings. Contraction joints shall be filled with a cementitious floor patch material and spanned with a crack isolation membrane similar to TEC #TA-329. Membrane shall extend a minimum of one full tile width to each side of the membrane along the entire length of the contraction joint.

### 3.4.2 Porcelain Tile

Porcelain floor tile shall be placed into the fresh mortar bed by pressing, then pushing and pulling the tile to achieve as near 100 percent coverage and contact of the tile with the mortar and substrate as possible. Mortar coverage shall be sufficiently distributed to give full support to the tile. All corners and edges shall be backed with mortar. A minimum mortar thickness of shall be maintained between the substrate and tile. Installer shall periodically remove tiles to assure proper bond coverage consistent with industry standards. Tile shall be installed in patterns and locations as indicated on the project drawings and approved shop drawings. Mortar and floor tile shall be installed in accordance with TCA Hdbk, method F 113-2K and ANSI 108.5.

#### 3.4.2.1 Porcelain Tile Base

Base shall be installed to floor and walls using industry standards. Base shall be backed with mortar including the void created where coved base is installed. Coved portion of coved base shall be flush with adjacent floor tile as detailed in the drawings.

### 3.4.3 Floor Tile Grout

Floor tile grout shall be installed in accordance with ANSI 108.10 and in strict accordance with manufacturers recommendations. Mixture rates and set-up times shall conform to manufacturer's instructions in order avoid grout discoloration. Joint size shall not exceed 3/16-inch in width.

## 3.5 INSTALLATION OF THRESHOLDS, TRANSITION STRIPS AND ACCESSORIES

Metal, rubber, and vinyl thresholds, transition strips, and other extrusion accessories as specified on the drawings used to transition tile flooring from other floor finishes or tile size shall be installed in accordance with the manufacturer's's recommendations and as located on the drawings. Thresholds and transition strips shall be installed the full width of openings or the entire length of the of the floorings to be transitioned.

### 3.6 INSTALLATION OF CAULK

An acrylic latex caulk shall be applied at all joints of material transition or where differential movement is known to take place. This shall include but is not limited to inside corners of rooms, at ceiling lines, around perimeters of vanities, etc. Grout fill at these locations is not acceptable. Caulk bead shall not exceed adjoining grout width and shall match the adjoining grout in color and texture.

### 3.7 CLEANING AND PROTECTING

Upon completion, tile surfaces shall be thoroughly cleaned in accordance with manufacturer's approved cleaning instructions. Acid shall not be used for cleaning glazed tile. Floor tile with resinous grout or with factory mixed grout shall be cleaned in accordance with instructions of the grout manufacturer. After the grout has set, tile wall surfaces shall be given a protective coat of a noncorrosive soap or other approved method of protection. Tiled floor areas shall be covered with building paper before foot traffic is permitted over the finished tile floors. Board walkways shall be laid on tiled floors that are to be continuously used as passageways by workmen. Damaged or defective tiles shall be replaced.

-- End of Section --

## SECTION 09671

## SEAMLESS RESINOUS FLOOR SYSTEM

05/99

## 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 basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIAL (ASTM)

ASTM C 307	Standard Test Method for Tensile strength of Chemical Resistant Mortar, Grout, and Monolithic Surfacing
ASTM C 413	(1988) Test Method for Absorption of Chemical Resistant Mortars, Grouts, and Monolithic Surfaces
ASTM C 531	(1990) Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts, and Monolithic Surfaces
ASTM C 579	(1990) Test Method for Compressive Strength of Chemical Resistant Mortars, Grouts, and Monolithic Surfaces
ASTM D 580	(1990) Test Method for Flexural Strength and Modulus of Elasticity of Chemical Resistant Mortars, Grouts, and Monolithic Surfaces
ASTM D 635	Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
ASTM D 2240	(1991) Test Method for Rubber Property - Durometer Hardness
ASTM D 4060	(1990) Test Method for Abrasion Resistance of Organic Coatings by Taber Abraser
ASTM D 4226	Standard Test Methods for Impact Resistance of Rigid Poly (Vinyl Chloride) (PVC) Building Products
ASTM D-4541	Standard Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. All items designated with a "G", including product literature, calculations, component data, certificates, diagrams, drawings, and samples shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

### SD-02 Shop Drawings

Resin-Based Flooring System; AE.

Shop drawings shall include floor plans indicating areas to be covered. Drawings shall include transition details to dissimilar materials.

### SD-04 Samples

Resin-Based Flooring System; AE.

Two 150 mm x 150 mm (minimum size) samples of each resinous flooring color specified.

### SD-05 Data

Resinous Flooring System; AE.

Flooring manufacturer's descriptive data, mixing, proportioning, and installation instructions. Maintenance literature for flooring shall be included.

### SD-06 Test Reports

Testing; AE.

Independent test reports certifying conformance to all minimum performance characteristics as specified below. Each report shall be properly identified. The test methods used shall be identified and the test results shall be recorded. I-P measurement testing results shall be allowed where standard testing methods use I-P, rather than metric, measurements.

### SD-07 Certificates

Resin-Based Flooring System; AE.

Manufacturer's certificates indicating conformance with specified requirements and flooring manufacturer's approval of the flooring applicator.

## 1.3 QUALITY ASSURANCE

### 1.3.1 Qualification of Applicator

Independent application contractor shall be approved and certified by the flooring manufacturer and shall have a minimum of 5 years experience in the application of the materials to be used. Contractor shall have completed at least five projects of similar size and complexity.

#### 1.3.2 Single Source Responsibility

Installer shall obtain primary resinous flooring materials including primers, resins, hardening agents, finish, and seaing coats from a single manufacturer with not less than ten years of successful experience in manufacturing and installing principal materials described in this section.

#### 1.3.3 Pre-Installation Conference

The General Contractor shall arrange a meeting not less than thirty days prior to starting work to include the General Contractor, Government Contract Representative, and the manufacturer/installer's representative.

#### 1.3.4 ISO Certification

All materials, including primers, resins, curing agents, finish coats, aggregates, and sealants shall be certified to be manufactured and tested under ISO 9002 registered quality system.

#### 1.4 DELIVERY AND STORAGE

Materials shall be delivered to the job site and checked by the flooring contractor for completeness and shipping damage prior to job start. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements are allowed. Material shall be stored in a dry, enclosed area protected from exposure to moisture. Temperature of storage area shall be maintained between 16 degrees C and 30 degrees C

#### 1.5 ENVIRONMENTAL REQUIREMENTS

Areas to receive industrial resin-based flooring shall have the slab and atmosphere maintained at a temperature above 10 degrees C for 2 days prior to installation and for 7 days following installation.

#### 1.6 PROJECT CONDITIONS

Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to resinous flooring. Job area shall be free of other trades during, and 24 hours after, flooring installation.

#### 1.7 FIELD EXAMPLES

Prior to commencing work the approved applicator shall install a 9 square meter sample at the jobsite for each color and pattern specified. Remove disapproved sample and reinstall sample as requested by the Contracting Officer's Representative until acceptable. The approved field example shall serve as the standard for the entire project.

#### PART 2 PRODUCTS

2.1 SEAMLESS RESINOUS FLOORING (SRF)

Resin-based flooring shall be broadcast (spray) applied type, solvent-free, seamless, epoxy resin floor finish system of 3 mm thickness with properties and chemical resistance conforming to the performance characteristics specified below. Product shall be composed of:

- 1) A two-component, penetrating, moisture tolerant epoxy primer.
- 2) A two-component, free-flowing epoxy formulation undercoat consisting of resin and curing agent
- 3) Colored quartz aggregate broadcast into both primer and undercoat.
- 4) A high performance, UV resistant, two component clear epoxy sealer.

Product shall be equal to STONCOR GROUP "STONHARD" StonShield SLT. Colors shall be as shown in the drawings.

2.1.1 Material Formulation

Floor system shall be a carefully graded blend of multi-colored, ceramic-coated quartz grains aggregate in a clear polymer matrix with a clear grout/topcoat. Finish shall be equal to Stonhard SLT "medium" texture. Topcoat finish shall be matte finish.

2.1.2 Coved Wall Base

A 100 mm high turned up coved base with a 25 mm radius cove shall be provided on all walls abutting the resinous flooring. Coved base shall be seamless and integral with the flooring material. Formed cove base shall same thickness as flooring. Top edge of coved base shall utilize manufacturer's standard edge detail incorporating J-molding or other transition strip material to achieve a smooth edge between the resinous flooring material and the adjacent wall finish.

2.2 PERFORMANCE CHARACTERISTICS

I-P measurement testing results are shown where standard testing methods use I-P, rather than metric, measurements. Resinous flooring shall meet the following minimum performance characteristics:

<u>Property</u>	<u>Test Method</u>	<u>Result</u>
Tensile Strength	ASTM C 307	1,600 psi
Coefficient of Expansion	ASTM C 531-90	1.8 x 10 <sup>-5</sup> in/in/0F
Compressive Strength	ASTM C 579-91	9,000 psi (72.0 MPa)
Water Absorption	ASTM C-413	0.1%
Flexural Strength	ASTM C 580-90	4,000 psi (22MPa)
Bond Strength	ASTM D-4541	400 psi (100% concrete failure)
Shore D Hardness	ASTM D 2240-91	85-90

<u>Property</u>	<u>Test Method</u>	<u>Result</u>
Abrasion Resistance	ASTM D 4060-90	0.06 grams max weight loss
Impact Resistance	ASTM D-4226	>160in lb
Flammability	ASTM D 635	self-extinguishing, extent of burning 0.25 in. max

2.3 CHEMICAL RESISTANCE

Resin-based flooring shall be chemically resistant and unaffected by the following:

20% Hydrochloric Acid	10% Lactic Acid
Urine	Tea
Coffee	Mustard
Ethyl Alcohol	Mercurochrome
Iodine	Betadyne

2.4 PRIMER

Primer shall be a material recommended and provided by the industrial resin-based flooring manufacturer which will penetrate the pores of the substrate and bond with the topping to form a permanent monolithic bond between the substrate and the topping.

2.5 RESIN

Binder and all successive grout and top coats shall be 100 percent solids clear/epoxy resin. No pigmented epoxy base or top coats shall be allowed. Resin shall be suitable for the type application indicated.

2.6 FILLERS

Floor system shall contain a carefully graded blend of multi-colored ceramic coated quartz grains. Fillers shall be furnished in the quantity necessary to impart the required color and physical characteristics. The filler shall contain sufficient fines to provide an even-textured, nonslip type of surface on the finished topping.

2.7 SEALER

Sealer shall be a product recommended by the industrial resin-based flooring manufacturer. When applied to the resin topping and dry, it shall be nonslip and resistant to staining.

2.8 ANTIMICROBIAL

Floor system shall contain an inherent broad-spectrum anti-microbial agent which shall actively inhibit the growth of fungi and prevent the proliferation of many types of gram-positive and gram-negative bacteria. The anti-microbial capability shall last throughout the life of the flooring system.

2.9 WATERPROOF MEMBRANE

An elastomeric waterproof membrane shall be installed at all below grade locations of seamless resinous flooring or as recommended by the resinous flooring applicator. Membrane shall be provided by the resinous flooring

manufacturer and shall be specifically designed for the type of resinous flooring installed.

### PART 3 EXECUTION

#### 3.1 PREPARATION OF CONCRETE SUBFLOOR

##### 3.1.1 Surface Preparation

A light steel trowel finish is required on all concrete subfloors to receive resinous flooring. Concrete must be clean, crack-free, sound and durable (minimum compression strength of 3000psi). Installation of the floor topping shall not commence until the concrete substrate is at least 28 days old. Concrete after surface preparation shall be free of sealers or membrane curing agents.

##### 3.1.2 Moisture Requirements

Concrete subfloor must be dry (3% maximum moisture content by mass.) before installation of resinous flooring is begun. Concrete must be free of hydrostatic and/or capillary moisture pressure and should not be in direct contact with the ground. An effective vapor barrier and properly engineered soil are required. Concrete subfloors containing destructive or non-destructive moisture shall be tested and prepared in accordance with resinous flooring manufacturer's instructions and recommendations.

#### 3.2 MIXING, PROPORTIONING, AND INSTALLING

Mixing, proportioning, and installing shall be in accordance with the approved instructions of the manufacturer using equipment specifically designed for the type of resinous flooring installed. Flooring shall be installed to a uniform nominal thickness of 3 mm utilizing a double broadcast application requiring aggregate to be broadcast separately into both the primer and resin undercoat. Single broadcast application method is not permitted. Apply elastomeric waterproof membrane in areas as recommended by the certified installer. Completed work shall match approved samples and shall be uniform in thickness, sheen, color, pattern, and texture. Completed work shall be free of defects detrimental to performance. A flooring manufacturer approved clear caulk or sealant shall be provided at all transitions of non-similar materials. Transitioning materials, sealants, and caulk at all floor drains shall be in accordance with manufacturer's approved shop drawings and written recommendations.

##### 3.2.1 Coved Base

Install seamless coved base at perimeter of all resinous flooring and at all other locations where the resinous flooring abuts wall surfaces. Coved base shall be trowel applied to a thickness equal to the flooring using the same materials as the flooring. Coved base shall be hand sanded, and include three coats of resin to assure a smooth surface and cove. Resin shall not be allowed to puddle in the cove. Provide a molding at the top of the base as as a transition and base edge protection. Molding type and profile shall be as shown on the drawings and recommended by the flooring manufacturer.

#### 3.3 PROTECTION

The resinous flooring shall be covered and protected from damage until completion of the work of all other trades.

-- End of Section --

## SECTION 09672

## CONDUCTIVE SEAMLESS RESINOUS FLOOR SYSTEM

05/03

## 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 basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIAL (ASTM)

ASTM C 307	(1999) Standard Test method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Coatings
ASTM C 413	(1988) Test Method for Absorption of Chemical Resistant Mortars, Grouts, and Monolithic Surfaces
ASTM C 531	(1990) Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts, and Monolithic Surfaces
ASTM C 579	(1990) Test Method for Compressive Strength of Chemical Resistant Mortars, Grouts, and Monolithic Surfaces
ASTM D 580	(1990) Test Method for Flexural Strength and Modulus of Elasticity of Chemical Resistant Mortars, Grouts, and Monolithic Surfaces
ASTM D 2047	(1999) Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine
ASTM D 2240	(1991) Test Method for Rubber Property - Durometer Hardness
ASTM D 4060	(1990) Test Method for Abrasion Resistance of Organic Coatings by Taber Abraser
ASTM D 4541	(2002) Standard Test method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
ASTM E 84	(1998) Surface Burning Characteristics of Building Materials

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. All items designated with a "G", including product literature, calculations, component data, certificates, diagrams, drawings, and samples shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

#### SD-01 Data

Resinous Flooring System; AE.

Flooring manufacturer's descriptive data, mixing, proportioning, and installation instructions. Maintenance literature for flooring shall be included.

#### SD-09 Reports

Testing; AE.

Reports of tests certifying conformance to all minimum performance characteristics as specified below. Each report shall be properly identified. The test methods used shall be identified and the test results shall be recorded.

#### SD-13 Certificates

Resin-Based Flooring System; AE.

Manufacturer's certificates indicating conformance with specified requirements and flooring manufacturer's approval of the flooring applicator.

#### SD-14 Samples

Resin-Based Flooring System; AE.

Two 150 mm x 150 mm (minimum size) samples of each resinous flooring color specified.

### 1.3 QUALIFICATION OF APPLICATOR

Independent application contractor shall be approved and certified by the flooring manufacturer and shall have a minimum of 5 years experience in the application of the materials to be used.

### 1.4 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers. Materials shall be kept in a clean, dry, area with temperatures controlled between 10 to 33 degrees C.

### 1.5 ENVIRONMENTAL REQUIREMENTS

Areas to receive industrial resin-based flooring shall have the slab and atmosphere maintained at a temperature above 10 degrees C for 2 days prior to installation and for 7 days following installation.

## PART 2 PRODUCTS

### 2.1 CONDUCTIVE SEAMLESS RESIN-BASED FLOORING SYSTEM(CSRF)

All products required to produce a finished floor system shall be from a single manufacturer. Flooring system shall consist of three major components:

- 1) Primer.
- 2) Mortar System Overlayment.
- 3) Topcoat.

#### 2.1.1 Primer

Primer shall be a penetrating, moisture tolerant, two-component epoxy based primer system to prepare surface for the application of the overlayment to ensure a secure bond between the substrate and overlayment. Primer shall be equal in physical characteristics and performance to Stonhard Standard Primer.

#### 2.1.2 Mortar System Overlayment

Overlayment shall be a high performance, charge dissipating, non-sparking, four-component epoxy mortar system. The system shall consist of an epoxy resin, amine curing agent, selected graded non-silica aggregates, and conductive elements. Mortar shall be sealed with a black conductive epoxy sealer to produce a conductive, spark-proof system throughout. Overlayment shall be equal in physical characteristics and performance to Stonhard "StonClad XP".

#### 2.1.3 Topcoat

Topcoat shall be a four-component, 100% solids, static control epoxy coating formulated to increase abrasion, static charge generation control, and chemical resistance. Topcoat shall be equal in physical characteristics and performance to Stonhard "StonKote AT5".

#### 2.1.4 Coved Wall Base

A 100 mm high turned up coved base with a 25 mm radius cove shall be provided on all walls and vertical sides of recessed floor slabs abutting the resinous flooring. Coved base shall be seamless and integral with the flooring material. Formed cove base shall same thickness as flooring. Top edge of coved base shall utilize manufacturer's standard edge detail incorporating J-molding or other transition strip material to achieve a smooth edge between the resinous flooring material and the adjacent wall finish.

### 2.2 PERFORMANCE CHARACTERISTICS

Resinous flooring system shall meet the following minimum performance characteristics:

<u>Property</u>	<u>Test Method</u>	<u>Result</u>
Tensile Strength	ASTM C 307	1,700 psi
Water Absorption	ASTM C 413	3.0%
Coefficient of Thermal Expansion	ASTM C 531	1.32 x 10 <sup>-5</sup> in/in/OF
Compressive Strength	ASTM C 579	8,500 psi after 7 days
Flexural Strength	ASTM C 580	2,800 psi
Curing Shrinkage	ASTM D 531	5.0 x 10 <sup>-5</sup> in/in Centigrade
Shore D Hardness	ASTM D 2240	75-8085
Abrasion Resistance	ASTM D 4060	0.08 gram maximum weight loss
Bond Strength	ASTM D 4541	>400 psi
Coefficient of Friction	ASTM D 2047	0.6
Flammability	ASTM E 84	Self-extinguishing

#### 2.2.1 Static Control and Spark Decay Properties

Resinous flooring system shall meet the following minimum performance characteristics:

<u>Property</u>	<u>Test Method</u>	<u>Result</u>
Surface Resistance	NFPA 99 Test Method, ASTM F 150-99	ATK 2.5 x 10 <sup>4</sup> -106 ohms
Static Charge Decay	MIL-B-81705B Federal Test Method Standard 101B, Method 4046	Dissipates a 5,000 volt charge to zero in less than 0.1 sec
Spark Generation	NFGS-09965	No Visible Sparks

#### 2.2.2 Chemical Resistance

Resin-based flooring shall be chemically resistant and unaffected by the following:

20% Hydrochloric Acid	10% Lactic Acid
Urine	Tea
Coffee	Mustard
Ethyl Alcohol	Mercurochrome
Iodine	Betadyne

#### 2.3 COLOR

Topcoat color shall be opaque and shall match the color as indicated on the drawings.

#### PART 3 EXECUTION

### 3.1 PREPARATION OF CONCRETE SUBFLOOR

#### 3.1.1 Surface Preparation

Substrate must be dry and free of all wax, grease, oils, fats, soil, loose or foreign materials and laitance. Substrate moisture content shall meet manufacturer's requirements before installation occurs.

### 3.2 MIXING, PROPORTIONING, AND INSTALLING

Mixing, proportioning, and installing of all system components shall be in accordance with the approved instructions of the manufacturer using equipment specifically designed for the type of resinous flooring installed. Flooring shall be installed to a uniform nominal thickness of 3 mm utilizing a "screed applicator". Completed work shall match approved samples and shall be uniform in thickness, sheen, color, pattern, and texture. Completed work shall be free of defects detrimental to performance. Contractor shall use manufacturer's standard installation details for contraction joints, control joints, and joints at floor drains.

#### 3.2.1 Coved Base

Install seamless coved base at perimeter of all resinous flooring and at all other locations where the resinous flooring abuts wall surfaces or vertical surfaces of depressed concrete slab. Coved base shall be trowel applied to a thickness equal to the flooring using the same materials as the flooring. Coved base shall be hand sanded, and include three coats of resin to assure a smooth surface and cove. Resin shall not be allowed to puddle in the cove.

### 3.3 TESTING

#### 3.3.1 Electrical Resistance

Seven days after the epoxy flooring installation is completed, the flooring will be tested for the electrical resistance with a minimum of one test for every 250 square feet of floor area. Test will be made only when the space is free from explosives or volatile flammable liquids or gases. The flooring and its grounding system will provide for electrical resistance, measured between the ground and a 5 pound electrode in direct contact with 4.9 square inches of floor area, not to exceed 1,000,000 ohms. The instrument used will be a suitably calibrated ohmmeter with two electrodes.

One electrode will consist of a special metal block 5 pounds in weight and 2.5 inches in diameter which makes contact with 4.9 inches of floor area. The block shall be equipped with a non-metallic strap to enable pulling it along the surface of the floor. The other electrode will consist of a suitable spring test clip for attachment to a permanent ground. The electrodes will be insulated from each other and be connected with instruments by test leads of sufficient length to allow all parts of the floor to be reached. The voltage applied to the instrument will be between 90 and 500 volts dc. Low voltage instruments may be used, but if the floor shows more than the maximum resistance with instruments of less than 500 volts, a test with a 500 volt instrument must be made. If the resistance is then greater than 1,000,000 ohms, and the floor and electrodes are free from insulating materials, the effectiveness of the floor grounds will be tested. Tests will be conducted by a technician experienced in such work and a copy of the results will be furnished to the contracting officer.

### 3.3.2 Spark Resistance

The floor will be tested for spark resistance by stroking the floor vigorously with a 12 inch hardened steel file in a 3 foot arc. The test will be performed for each 80 square feet of floor area. Tests will be made in a darkened space and only when the relative humidity of the space does not exceed 50 percent. The floor will not produce a spark when tested under these conditions. The resistance of the floor will be more than 5,000 ohms in areas with 110 volts service, more than 10,000 ohms in areas with 220 volt service, and less than 1,000,000 ohms in all areas. A copy of the test results shall be furnished.

### 3.4 PROTECTION

The resinous flooring shall be covered and protected from damage until completion of the work of all other trades.

-- End of Section --

## SECTION 09920

## CONTRACTOR COLOR BOARDS

08/99

## PART 1 GENERAL

## 1.1 GENERAL

This section covers only the color of the exterior and interior materials and products that are exposed to view in the finished construction. Reference the INTERIOR FINISH MATERIALS LEGEND in the drawings for those interior finishes and items requiring color selection. The word "color" as used herein includes surface color and pattern. Requirements for quality and method of installation are covered in other appropriate sections of the specifications. Specific locations where the various materials are required are shown on the drawings. Items not designated for color in this section may be specified in other sections. When color is not designated for items, the Contractor shall propose a color for approval.

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

## SD-14 Samples

Color board; G, EC (Two Sets) AE (One Set).

3 sets of color boards.

## PART 2 PRODUCTS

## 2.1 COLORBOARDS

## 2.2 Binder Cover

All colorboards shall be presented in a set of 3-ring "D" binders large enough to adequately hold all colorboards. Binders shall include plastic sleeves on the front and spine to accept contractor supplied inserts with the project name, number, and date.

## 2.3 Boards

The colorboards shall be fabricated from presentation (mat) board with a rigid substrate such as foam core board to provide a stable surface for sample attachment.

## 2.4 Samples

Colorboard samples shall reflect all actual finish textures, patterns, and colors required for this contract as specified in the Interior Finish Schedule, Exterior Finish Schedule, and the Interior Finish Materials Legend found in the Contractor's AE design drawings. Patterned samples

shall be of sufficient size to adequately show the pattern and its repeat if a repeat occurs.

## 2.5 Sample Labeling

All samples shall be labeled on the colorboards with the manufacturer's name, and the pattern and color name and number. Samples shall also be keyed or coded to match any key or code system used in the Contractor's AE design drawings.

## 2.6 REFERENCE TO MANUFACTURERS COLORS

Manufacturers' colors specified in the approved AE design and shown on the AE design colorboards shall not be intended to limit the selection of equal products from other manufacturers by the Contractor. However, variances from the manufacturer's colors shown on the approved AE design colorboards, drawings, and specifications must be annotated and highlighted for review.

## 2.7 MATERIAL QUALITY

Samples submitted as part of the Contractor color boards are for color, pattern, and texture approval only. Material quality including specifications and performance requirements shall be reviewed as part of the material's individual submittal section as shown in the submittal register as part of 01330, Submittal Procedures. Samples approved as part of the color board submittal may be disapproved at a later date if, after review, specifications or performance characteristics do not meet the project requirements.

# PART 3 EXECUTION

## 3.1 MOUNTING

All samples shall be securely mounted to the presentation boards using hot-melt glue or other permanent adhesive which will insure the samples will not come loose during shipping or use.

-- End of Section --

DIVISION 10 – SPECIALTIES

10000	Division 10: Specialties - Outline Specifications
10100	Visual Communications Specialties
10500	Lockers

SECTION 10000

DIVISION 10: SPECIALTIES - OUTLINE SPECIFICATIONS  
01/02

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

1.1.1 Contractor Edited Guide Specifications

The contractor shall edit and provide the following UFGS guide specifications for Division 10: SPECIALTIES:

Section 10160A, TOILET PARTITIONS

Section 10260A, WALL PROTECTION

Section 10440A, INTERIOR SIGNAGE

Section 10800A, TOILET ACCESSORIES

1.1.2 Government Edited Specifications

The contractor shall incorporate the following government-supplied, fully edited specification sections as part of the project design:

Section 10180, SHOWER DOOR

Section 10500, LOCKERS

1.1.3 Contractor Created Specifications

As part of the project design, the contractor shall create and provide the following specification sections:

Section 10520, FIRE EXTINGUISHER CABINETS AND ACCESSORIES

Section 10670, METAL UTILITY SHELVING

Specifications shall be created and provided in Specsintact format.

1.2 REFERENCES

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

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-2398 (Rev B) Curtain, Shower and Window

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 221 (1996) Aluminum and Aluminum-Alloy

Extruded Bars, Rods, Wire, Profiles, and Tubes

- ASTM D 256 (1997) Determining the IZOD Pendulum Impact Resistance of Plastics
- ASTM D 635 (1998) Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
- ASTM D 1308 (2002) Standard Test method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
- ASTM E 84 (1998e1) Surface Burning Characteristics of Building Materials
- ASTM D 792 (1992) Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- ASTM C 1036 (1991) Flat Glass

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI 299.1 (1975) American National Standard Performance Specifications and Methods of Test For Safety Glazing Material Used in Buildings

CODE OF FEDERAL REGULATIONS (CFR)

- 28 CFR Part 36; Appendix A (1994) Americans with Disabilities Act (ADA) Standards for Accessible Design

1.3 SECTION 10160A, TOILET PARTITIONS

1.3.1 Material and Performance Criteria

The contractor edited specification section shall include the following material physical characteristics and performance criteria:

- A. Partition system shall be constructed of solid phenolic material to include a solid phenolic black edge on all panels, stiles, and doors. Phenolic panels shall have a minimum density (specific gravity) of 87.5 ft/lb<sup>3</sup> in accordance with ASTM D 792.
- B. Partitions shall be floor anchored style with overhead bracing.
- C. All hardware shall be 304 stainless steel. Finish shall be highly resistant to alkalis, urine, and other common toilet room acids.
- D. Partitions and stalls designed for handicap accessibility shall meet all 28 CFR Part 36; Appendix A (ADA) requirements.
- E. Provide institutional hardware equal in construction and performance to BOBRICK "Institutional Hardware."
- F. Minimum 10-year warranty against delamination, corrosion, or

breakage.

### 1.3.2 Installation Criteria

The contractor edited specification section shall include the following installation criteria:

A. Provide internal structural wall support at all locations where toilet partitions or overhead bracing are attached to the walls. Attachment to wall substrate only is prohibited.

### 1.4 SECTION 10180, SHOWER DOOR

Shower doors for location in shower stall entries shall be a heavy-duty, light commercial model and shall exceed requirements and specifications for typical residential-type shower doors.

#### 1.4.1 Material and Performance Criteria

The contractor edited specification section shall include the following material physical characteristics and performance criteria:

- A. Swinging door for shower unit shall have adjustable jambs for adjustment up to 25 mm .
- B. The enclosure and door frame components shall be fabricated from extruded aluminum 6463-T5 or 6063-T5 depending on application and meet or exceed ASTM B221 requirements.
- C. Hinge shall be heavy-duty, continuous, piano-type.
- D. Door and enclosure shall include a continuous magnetic seal running the length of the door.
- E. Enclosure unit shall include aluminum bottom sill component.
- F. Enclosure frame width shall be a minimum of 25 mm . Door frame width shall be a minimum of 38 mm.
- G. All exposed and semi-exposed enclosure and door frame metal surfaces shall have a satin anodized aluminum finish.
- H. Tempered door glass shall be 6 mm thick and shall meet or exceed ANSI 299.1. Door glass shall be obscure.

#### 1.4.2 Installation Criteria

The contractor edited specification section shall include the following installation criteria:

- A. Installation shall be in accordance with the manufacturer's recommendations and approved shop drawings.
- B. The manufacturer shall warrant that the shower unit shall be free from defects in materials and workmanship and remain in such condition for a period of three (3) years from the date of Substantial Completion, and will repair or replace (manufacturer's option) any door or enclosure frame shown defective under normal use.

## 1.5 SECTION 10260A, WALL PROTECTION

### 1.5.1 Material and Performance Criteria

The contractor edited specification section shall include the following material physical characteristics and performance criteria:

#### 1. Wall Guards and Corner Guards.

A. General. Units shall be surface mounted. Mounting hardware and base plates shall be furnished. Assembly shall consist of a snap-on cover formed from high impact resistant resilient material, minimum thick, mounted on a continuous aluminum retainer with no visible fasteners upon completion of installation. Aluminum retainer shall have a minimum thickness of and shall be installed over the wall finish material.

B. Resilient Material. Resilient material shall consist of high impact resistant extruded acrylic vinyl, polyvinyl chloride, or injection molded thermal plastic and shall conform to the following:

1) Minimum Impact Resistance. Minimum impact resistance shall be when tested in accordance with ASTM D 256, (Izod impact, ft. lbs per sq inch notched).

2) Fire Rating. Fire rating shall be Class 1 when tested in accordance with ASTM E 84, having a maximum flame spread of 25 and a smoke developed rating of 450 or less. Material shall be rated self extinguishing when tested in accordance with ASTM D 635. Material shall be labeled and tested by an approved nationally known testing laboratory. Resilient material used for protection on fire rated doors and frames shall be listed by the testing laboratory performing the tests. Resilient material installed on fire rated wood/steel door and frame assemblies shall have been tested on similar type assemblies. Test results of material tested on any other combination of door/frame assembly will not be acceptable.

3) Integral Color. Colored components shall have integral color and shall be matched in accordance with SAE J1545 to within plus or minus 1.0 on the CIE-LCH scales.

C. Aluminum Retainers. Retainers shall be fabricated from extruded aluminum alloy 6030-T6. Minimum strength and durability properties as specified in ASTM B221. Thickness shall be as indicated in this specification for each type of wall protection.

D. Corner Guard Assemblies. Corner guard assemblies shall be surface mounted. Resilient acrylic/vinyl cover shall snap over wall-mounted aluminum retainer with no visible fasteners. Corner guards shall extend from the top of wall base to the ceiling unless otherwise noted on the drawings. Corner guard face shall be 76 mm wide with a radiused, bullnose profile. Factory fabricated end closure caps shall be furnished for top and bottom of surface mounted corner guards. Corner Guard assemblies to include matching sheet vinyl shall be provided for walls requiring end caps.

E. Wall Guard (Chair Rail) Assemblies. Shall be provided with prefabricated end closure caps, outside corners, concealed splices,

cushions, mounting hardware and other accessories standard with the manufacturer. End caps and corners shall be field adjustable to assure close alignment with wall guards. Wall guards shall be in profiles and colors as shown on the drawings. Wall guard face shall be a minimum high and a maximum deep and shall equal in profile design and performance to Construction Specialties' Model No. SCR-48S.

## 2. Vinyl Acrylic Wallcovering.

A. Wallcovering shall be a semi-rigid, integrally colored product with a minimum thickness of .030". Product and surface pattern shall be equal to Construction Specialties model: ".030" Semi-Rigid", pattern: Quartz.

B. Wallcovering product shall be designed to provide a seamless appearance and shall not require the use of vertical batten strips at seams for secure installation.

C. Wallcovering shall be considered Class 1 fire rating in accordance with ASTM E 84.

D. Wallcovering shall be chemical and stain resistant in accordance with ASTM D 1308.

### 1.5.2 Installation Criteria

The contractor edited specification section shall include the following installation criteria:

A. Continuous horizontal structural internal wall support shall be provided for evenly spaced anchorage of the wall guard aluminum retainer to the wall.

B. All wall guards shall terminate a uniform distance of at inside corners and from all door frames, window frames, corner guards, and other wall-mounted items intersecting the wall guard location.

C. Semi-rigid wallcovering shall be used as a protective wainscot and installed with the pattern oriented vertically, thereby minimizing the number of seams and applying the wallcovering with the roll width being the height of the wainscot.

D. Where more than one dye lot is used, any new lot of wallcovering shall be started at an inside or outside corner to avoid noticeable differences between dye lots.

### 1.6 SECTION 10520, FIRE EXTINGUISHER CABINETS AND ACCESSORIES

#### 1.6.1 Material and Performance Criteria

The contractor created and edited specification section shall include the following material physical characteristics and performance criteria:

A. Die-formed steel cabinet, trims and door frames, with factory finish of baked enamel, flush, or semi-recessed mounted type as appropriate, with rolled return trim and vertical half glass type door panels with a handle. Administrative area cabinets shall accommodate 4.5 Kg ABC extinguishers.

## 1.7 SECTION 10440A, INTERIOR SIGNAGE

### 1.7.1 Material and Performance Criteria

The contractor edited specification section shall include the following material physical characteristics and performance criteria:

- A. All signage shall be supplied by and produced from a single manufacturer.
- B. All signage shall meet 28 CFR Part 36; Appendix A (ADA) requirements with regard to raised typography and corresponding Braille.
- C. All signage shall utilize a common background, frame style, and typography color.
- D. Each room shall be supplied with a room identification sign consisting of a x plaque face and a separate, square holder with raised frame edge.
- E. All room identification plaque signage with the exception of toilet rooms shall contain a high, Helvetica Bold, raised room number in the upper left hand portion of the sign face. The lower portion shall contain the raised room name, Helvetica Medium, all caps, high, left justification.
- F. Room numbering shall be logical and sequential, clockwise from main building entry, and shall not be dependent on architectural room numbering scheme.
- G. Toilet Room pictographs shall include the universal symbol for man or woman and also the handicap symbol where applicable. Unisex toilets shall contain both man and woman pictographs. Pictographs shall be provided subsurface.
- H. Construction, quality, and performance shall be equal to APCO "IM Series".

### 1.7.2 Installation Criteria

The contractor edited specification section shall include the following installation criteria:

- A. All room identification signage shall be located and installed on the wall to the to the latch side of the door opening wherever possible. Toilet room signage shall be centered on the doors.
- B. All signage shall be mounted flush to the wall utilizing a slotted, tamper-proof backplate mounting system with concealed mechanical fasteners, one per corner.

### 1.7.3 Master Signage List

The specification section shall include a master signage list which is coded and cross-referenced to a drawing location plan which identifies each sign, sign type, along with the required room number, room name, and typography symbol (where required).

## 1.8 SECTION 10670, METAL UTILITY SHELVING

Utility shelving shall be a heavy-duty type constructed of steel components and attachments with steel or particleboard shelving surfaces. Shelving units shall be to dimensions and in locations as shown on the drawings. Unit widths shall vary as necessary and provided in combinations of starter and add-on units in order to provide the overall lengths shown on the drawings.

#### 1.8.1 Enclosed Heavy-Duty Shelf Units

The contractor edited specification section shall include the following material physical characteristics and performance criteria for enclosed shelving:

- A. Shall include end panel, back panel, enclosed base, and top with a minimum of 5 adjustable shelves for each unit.
- B. Posts shall include both angle and box posts.
- C. The base and top shall be considered shelving surfaces and shall be constructed of the same gauge as the adjustable shelving.
- D. Shelving shall be rated as heavy-duty, Class 1 and shall be constructed with front and rear box beam flanges for superior shelf rigidity.
- E. All components shall be receive a factory baked enamel finish.
- F. Shelving units shall be equal in construction, metal gauge, and design to PENCO "Clipper" industrial shelving.
- G. Shelving unit depth shall be and a minimum height of .

##### 1.8.1.1 Location

Enclosed storage shelving units shall be located in Tool Room 103 (Refueler Maintenance Facility).

#### 1.8.2 Installation Criteria

The contractor edited specification section shall include the following installation criteria for all metal utility shelving:

- A. Each unit shall be securely anchored to the walls, floor, and adjoining units.

### 1.9 SECTION 10800A, TOILET ACCESSORIES

#### 1.9.1 General Requirements

All accessories shall be constructed of Type 304 stainless steel with a brushed finish unless otherwise noted. Where applicable, accessories shall meet all requirements of 28 CFR Part 36; Appendix A (ADA) requirements.

#### 1.9.2 Material and Performance Criteria

The contractor edited specification section shall include the following material physical characteristics and performance criteria for each of the toilet accessories listed below:

- A. Toilet Tissue Holder: Type II - with two rolls of standard tissue stacked vertically with a tripping mechanism for automatically dispensing the stored roll upon depletion of the bottom roll. Cabinet shall have all edges radiused with no sharp corners, edges, or protruding surfaces. Vertical access door shall be flush with exposed paper roll face below. (Similar to BOBRICK model no. B-4888 for recessed and B-4288 for surface mount).
- B. Sanitary Napkin Disposer: Unit shall contain a removable, leak-proof receptacle for disposable liners. Fifty disposable liners shall be provided for each unit installed. Removable receptacle shall be retained in cabinet by tumbler lock. Unit shall include a door for inserting disposed napkins. (Similar to BOBRICK model no. B-353 for recessed and B-254 for surface mount.)
- C. Coat/Clothes Hook: Coat hook shall have two projections utilizing a wide metal band with a maximum projection to minimize eye-poke hazard. Hook shall be attached to a square flange. Flange is attached to the mounting surface with hidden fasteners. (Similar to BOBRICK model no. B-682).
- D. Grab Bars: Grab bar shall be 18-gauge, OD stainless steel. Lengths shall be indicated on the AE drawings. Exposed mounting flange shall have set screw mounting holes concealed on the lip of the flange. Installed bars shall be capable of supporting a vertical load without coming loose and without obvious permanent deformation. Space between wall and grab bar shall be .
- E. Soap Dispenser: Shall be horizontal surface-mounted, liquid soap type. Tank holding capacity of minimum with a corrosion-resistant all-purpose valve mechanism with O-ring seals. Dispenser shall include vandal-resistant mounting, a hinged, lockable filler top, and polycarbonate refill window. (Similar to BOBRICK model no. B-4112).
- F. Combination Paper Towel Dispenser/Waste Receptacle Units: Dispenser/receptacle shall be semi-recessed and shall have a capacity of 600 sheets of C-fold, single-fold, or quarter-fold towel. Waste receptacle shall be designed to be locked in unit and removable for service. Locking mechanism shall be tumbler key lock. Waste receptacle shall have a capacity of 45 L. Unit shall be fabricated of not less than 0.8 mm stainless steel welded construction with all exposed surfaces having a satin finish. Waste receptacle that accepts reusable liner standard for unit manufacturer shall be provided. Unit shall be equal in size and specifications to Bobrick model no. 3944.
- G. Multiple Hook Strip: Hook strip shall be equal to Bobrick Model No. B-232 x 24. Unit shall consist of three hooks matching single coat hook listed above. Hooks shall be spaced equally on a deep formed panel. All components shall be Type 304 stainless steel with a satin finish.
- H. Electric Hair Dryer: Hair dryer unit shall be equal in performance and construction to Bobrick Model No. B-7317. Electric hair dryer shall be wall mounted and shall be designed to operate on 110/125 volts, 60 cycle, single phase alternating current with a heating element core rating of not more than 2300 watts. Dryer housing shall be of single piece cast iron construction and shall have a black vitreous enamel finish. Nozzle shall be fixed in a downward direction.

Recessed button with automatic 80 second shutoff. Unit motor shall have 1/10 hp, 6200 rpm motor with automatic thermal overload switch. Centrifugal fan shall deliver a minimum 150 cfm. Unit shall be UL and C-UL listed. Provide one unit at each shower area at a height and location as shown on the drawings.

I. Shower Curtain Rod: Unit shall be equal in to Bobrick model no. B-6107. Shower curtain rod shall be type-304, 1.0 mm stainless steel tubing with satin finish and 25mm outside diameter. Flanges shall be type-304, 1.0 mm stainless steel with satin finish and drawn, one-piece, seamless construction. Lengths shall be as required to span shower stall openings wall-to-wall.

J. Shower Curtain: Vinyl shower curtain shall conform to CID-A-A-2398, Style I. Curtain shall have a minimum 100mm double hem, both top and bottom. Curtain length shall provide a maximum clearance of 13mm from the shower receptor floor to the bottom of the hem. Curtain width shall be of ample width to fully enclose the wall to wall opening. Curtain rings shall be type-304 stainless steel, polished finish. Holes in shower curtain to retain rings shall be reinforced with stainless steel grommets. Manufacturer shall supply a range of colors for selection.

K. Mirror Glass: Glass for mirrors above each restroom vanity countertop shall be Type I transparent flat type, Class 1-clear. Glazing Quality q1 6 mm thick conforming to ASTM C 1036. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 6 mm thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication. Width dimension shall be maximum size available to minimize vertical seams.

L. Paper towel Dispenser: Wall-mounted unit shall have a minimum capacity of of 400 C-fold or 525 multifold towels and be equal to Bobrick model no. B-262. Door shall have tumbler lock and piano hinge. Unit shall be satin finish stainless steel.

M. Waste Receptacle: Wall-mounted unit shall be equal in size and construction to Bobrick model no. B-279. Unit shall be satin finish stainless steel with hemmed bottom edges. Unit shall include hooks to hold removable vinyl liner for cleaning.

N. Mop Rack: Wall-mounted unit shall be equal to Bobrick model no. B-239 to include a minimum of 3 each anti-slip mop holders which shall be spring-loaded rubber cam operation that grip handles. Unit shall include 4 double-prong hooks for hanging and a 8" deep, 18-gauge over-shelf running the full width of the unit. Steel components shall be type-304, satin finish.

### 1.9.3 Installation Criteria

The contractor edited specification section shall include the following installation criteria for all metal utility shelving:

A. At locations where units are installed to wall surfaces, structural support within the wall shall be provided and the unit shall be attached to this support. Attachment to substrate only is prohibited.

B. Accessories shall be supplied in quantities and locations as indicated on the drawings.

C. Installation locations shall be in accordance with 28 CFR Part 36; Appendix A (ADA) requirements and shall supercede, as necessary, any dimensions shown on the drawings.

-- End of Section --

## SECTION 10100

VISUAL COMMUNICATIONS SPECIALTIES  
05/99

## 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 basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 221	(1995a) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
ASTM B 209	Aluminum-Alloy Sheet and Plate
ASTM A 424	Steel Sheets for Porcelain Enameling of Building Materials

## 1.2 GENERAL REQUIREMENTS

The term visual communications specialties includes display track systems, enclosed notice board cases, projection screens, and TV monitor yoke mounts.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. All items designated with a "G", including product literature, calculations, component data, certificates, diagrams, drawings, and samples shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

## SD-01 Data

Display Track System; AE.

Projection Screens; AE

Enclosed Notice Board Case; AE

TV Monitor Yoke Mount Unit; AE

Manufacturer's descriptive data and catalog cuts.

SD-04 Shop Drawings

Display Track System; AE.

Projection Screens; AE.

Enclosed Notice Board Case; AE.

TV Monitor Yoke Mount Unit; AE

Submit shop drawings showing location plan, layout, elevations with dimensions, dimensioned cross-sections, mounting method, and fastener location.

SD-06 Instructions

Display Track System

Projection Screens

Enclosed Notice Board Case

TV Monitor Yoke Mount Unit

Manufacturer's installation instructions, and cleaning and maintenance instructions.

SD-14 Samples

Display track system; AE

Submit typical sections of aluminum track rail, track cover (where applicable), panel frame and connector, dry marker/eraser tray, and porcelain finish in sufficient size to show construction, shape. Submit sections of porcelain steel writing surface and fabric covered tackable surfaces to include core material and backing. Finish and color of all components shall match those specified. Finish and color requirements shall not be limited to manufacturer's standard finish selections in order to meet these requirements.

Enclosed Notice Board Case; AE

Submit typical sections of frame in sufficient size to show construction, shape and specified finish. Submit samples of cork tackable surface. Finish and color of all components shall match those specified. Finish and color requirements shall not be limited to manufacturer's standard finish selections in order to meet these requirements.

1.4 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered to the building site in the manufacturer's original unopened containers and shall be stored in a clean dry area with temperature maintained above 50 degrees F. Materials shall be stacked according to manufacturer's recommendations. Visual display boards shall be allowed to acclimate to the building temperature for 24 hours prior to installation.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Porcelain Enamel

Marker board writing surface shall be composed of porcelain enamel fused to a nominal 0.378 mm (28 gauge) thick steel, laminated to a minimum 6 mm thick core material with a steel or foil backing sheet. Writing surface shall be capable of supporting paper by means of magnets. Marker board surface for display track system may be a powder paint dry erase surface adhered to a nominal 1.214 mm (18 gauge) thick steel.

#### 2.1.2 Cork

Cork shall be a continuous resilient sheet made from soft, clean, granulated cork relatively free from hardback and dust and bonded with a binder suitable for the purpose intended. The wearing surface shall be free from streaks, spots, cracks or other imperfections that would impair its usefulness or appearance. The material shall be seasoned, and a clean cut made not less than 13 mm from the edge shall show no evidence of soft sticky binder. Material shall be a single layer of pure grain natural cork without backing or facing. The color shall be light tan. The cork sheet shall have a tensile strength of not less than 275 kPa when tested in accordance with ASTM F 152.

#### 2.1.3 Aluminum or Steel

Aluminum track and frame extrusions shall be alloy 6063-T5 or 6063-T6, conform to ASTM B 221, and be a minimum thick. Aluminum sheet goods shall conform to ASTM B 209. Steel products shall conform to ASTM A 424 for porcelain covered steel sheet components. Exposed aluminum or steel shall have a finish as indicated. Straight, single lengths shall be used wherever possible. Joints shall be kept to a minimum. Corners shall be mitered and shall have a hairline closure.

#### 2.1.4 Glass

Glass shall be comprised of tempered glass in accordance with ANSI Z97.1 and shall conform to ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class I (clear), thickness as specified.

## 2.2 FABRICATED UNITS

### 2.2.1 Display Track System

This method of display shall be a flexible and interchangeable system that consists of lightweight presentation components suspended from a wall mounted, linear, horizontal track. Presentation components shall be capable of being lifted from the track and being relocated to allow for their re configuration. Components shall be capable of being installed on the track without the use of tools for installation, removal, and re configuration. The presentation hanging components shall consist of a panel with adjustable flipchart that adapts to fit any size pad holes and

spacing and a dry-erase marker board. Marker boards shall be provided with a marker tray. Marker board surface shall accept magnets. Dry erase markings on the marker board shall be removable with a felt eraser or dry cloth without ghosting. Each marker board unit shall come complete with an eraser and four different color compatible dry erase markers. Wall mounted rail system to support demountable and moveable visual aid components shall be equal to Egan Visual, Inc. "EganSystem". Component specifications are as follows:

#### 2.2.1.1 Components

Component finishes shall match those indicated below. Components shall include:

- a. **Rail (track):** Aluminum track with plastic cover mounts in 8 foot lengths. Quantity shall be sufficient to span the walls noted on the drawings. Plastic cover color shall match Egan Visual's "Putty".
- b. **Porcelain Markerboard:** Porcelain on steel writing (dry marker) and magnetic surface. Reversible. Minimum dimensions: 36 inches high by 48 inches wide. Porcelain color shall match Egan Visual's "Eganboard" Cool Gray. Frame color shall match Egan Visual's "Putty". Dimensions: wide by high.
- c. **Marker Accessories:** Includes magnetic tray/rail, 4 markers, and 1 eraser.
- d. **Flipchart Holder:** Holder is magnetic and adheres to any steel surface.
- e. **Flipchart Replacement Pads:** Set includes 5 each pads.

#### 2.2.1.2 Quantities

Each room (location) where the display track system is installed shall receive the following component quantities:

- a. Porcelain Markerboard: 6 each.
- b. Marker Accessory Set: 2 each.
- c. Flipchart Holder: 2 each.
- d. Flipchart Replacement Pads: 10 each.

#### 2.2.2 Enclosed Notice Board Case

The surface mounted cabinet case shall have a metal frame enclosure with a metal framed glass door equal to APCO (Atlanta, GA, 404/688-9000) "Visualine 2350" Series. Cabinet and door frame finish shall be black anodized. Dimensions shall be approximately 1500 mm wide x 900 mm high x 60 mm deep.

Component specifications are as follows:

##### 2.2.2.1 Housing

Cabinet housing shall be constructed of 6063-T5 extruded aluminum alloy in accordance with ASTM B221-90. Housing shall surround a solid backing plate

with PVC laminated to the solid backing. Unit shall be assembled with hairline fit corners and joints. Unit shall include interlocking aluminum channel mounting bracket to support flush mounted installation.

#### 2.2.2.2 Door

Cabinet door frame shall be constructed of 6063-T5 extruded aluminum alloy in accordance with ASTM B221-90 with a minimum thickness of 3.2 mm. Corners shall be precision hairline mitered. Frame profile shall be beveled. Door component specifications shall be as follows:

- A. Glazing. Glass shall be standard 6 mm thick, polished clear color glass fully tempered in accordance with ANSI Z97.1-1984.
- B. Hinges. Hinges shall be a continuous stainless steel hinge.
- C. Door Lock. Cabinet doors shall be equipped with a factory installed, side-mounted plunger lock. A minimum of two keys shall be provided.

#### 2.2.2.3 Cabinet Interior Face

Cabinet interior component specifications shall be as follows:

- A. Header Panel. Cabinet interior face shall include a 100 mm high acrylic header panel fabricated from 3 mm thick material. Header panel color shall be black. Silk screened, white lettering shall be 38 mm high upper and lower case Helvetica Medium lettering with a Center/Center (CC) justification. Text shall be as indicated by Government's COR.
- B. Cork Surface. Interior face of cabinet interior shall be a cork board comprised of 6 mm thick self-healing cork. Cork color shall be natural.

#### 2.2.2.4 Fabrication

Cabinets shall be shop assembled and fabricated to configurations and dimensions shown on the project drawings and approved shop drawings. Units shall be internally reinforced in accordance with approved shop drawings.

#### 2.2.3 Projection Screens

Projection screen units shall be wall surface mounted consisting of a screen and housing unit specifically designed for a surface mounted installation. Screen shall be manual control, spring tension type. Units shall be equal in construction and performance to DA-LITE "Model C" (3100 North Detroit Street, PO Box 137, Warsaw, IN 46581-8101, ph: 800/622-3737).

Case shall be baked enamel finish. Screen dimensions shall be 1524 mm by 1524 mm with an overall case size of 1606 mm long by 118 mm deep by 149 mm high. A screen shall be installed in each Company Operations Facility conference room as shown on the drawings. Screen location shall be centered on the wall.

##### Dimensions:

Screen dimensions shall be 1524 mm by 1524 mm with an overall case size of 1606 mm long by 118 mm deep by 149 mm high. Screen location shall be centered on the wall as shown on the drawings.

#### Mechanical System Requirements:

The roller shall be made of 76 mm diameter ball bearing rigid steel spring roller. Fabric shall be attached to roller by metal clips on fabric edge forced into groove on roller. There shall be a clip every 76 mm along the fabric edge and double clips shall be used on the ends. Case shall be 22-gauge steel with flat back design finished with baked enamel. Case shall have powder coated steel end caps concealing roller ends with steel inner plates to support roller and provide added case strength. End caps shall form sturdy brackets for wall installations.

#### Screen Specifications:

The picture screen fabric shall be seamless flame-retardant and mildew-resistant fiberglass with a Glass Beaded picture surface and black masking borders. Bottom of fabric shall be formed into a pocket holding a tubular metal slat. An extruded aluminum saddle with plated steel pull shall be attached to the slat by four screws at each end. The ends of the slat shall be protected by heavy-duty plastic caps. Metal bumper stops padded with sponge rubber shall be built into the case to prevent slat wedging inside case.

#### 2.2.4 TV Monitor Yoke Mount Unit

Unit shall be designed for ceiling mounted application. Unit shall swivel 360 degrees and have a minimum tilt adjustability from 0-15 degrees for optimum viewing. Unit shall be adjustable and shall have the capacity to hold from 19-inch to 40-inch diagonal sized TV monitors and supports up to 300 pounds. Unit shall be constructed of heavy-duty steel tube and T-bar design with a black powder coated finish. All joints shall be robotic arc welded. Sure clamping stirrups shall hold monitors securely in place. Unit shall be equal in design, materials, and performance to DA-LITE model no. CMY-2134 (3100 North Detroit Street, PO Box 137, Warsaw, IN 46581-8101, ph: 800/622-3737).

### PART 3 EXECUTION

#### 3.1 PLACEMENT SCHEDULE

Location and mounting height of visual display boards shall be as shown on the drawings.

#### 3.2 CONSTRUCTION REQUIREMENTS AND COORDINATION

Walls shall be constructed with sufficient structural support as needed to support the weight and use of rail/components, wall cabinets, enclosed display case, and projection screens in locations as indicated on the drawings and in accordance with each manufacturer's recommendations.

#### 3.3 INSTALLATION

Installation and assembly shall be in accordance with manufacturer's printed instructions and approved shop drawings for ceiling mounting surface and method. Concealed fasteners shall be used. The Contractor shall furnish and install trim items, accessories and miscellaneous items in total, including but not limited to hardware, grounds, clips, backing

materials, adhesives, brackets, and anchorages incidental to or necessary for a sound, secure, complete and finished installation. Installation shall not be initiated until completion of room painting and finishing operations. All items shall be installed in locations and at mounting heights indicated. Damaged units shall be repaired or replaced by the Contractor as directed by the Contracting Officer.

### 3.3.1 Display Track System

Display track system track component shall be wall-mounted to structural wall support. Mounting to gypsum board substrate only is prohibited. Contractor shall provide additional structural wall support as needed to support the weight of the track and track-hung components in accordance with the display track system manufacturer's recommendations.

### 3.3.2 Enclosed Notice Board Case

The cabinet case shall be wall-mounted to structural wall support in locations and at heights shown on the drawings. Mounting to gypsum board substrate only is prohibited. Contractor shall provide additional structural wall support as needed to support the weight of the case in accordance with the case manufacturer's recommendations.

### 3.3.3 Projection Screens

Cases shall be attached to the building ceiling structure with suitable devices to anchor each unit. Fastening to the acoustical ceiling grid is prohibited. Projection screens shall be installed at finished ceiling height. Installation location shall provide adequate wall clearance so that the screen is clear of all wall mounted items in the screen's downward path of travel.

### 3.3.4 TV Monitor Yoke Mount Unit

Units shall be attached to the building ceiling structure with suitable devices to anchor each unit in locations as shown on the drawings. Fastening to the acoustical ceiling grid is prohibited. Bottom of the unit shall be [ ] from the finished floor.

## 3.4 CLEANING

Writing surfaces shall be cleaned in accordance with manufacturer's instructions.

-- End of Section --

## SECTION 10500

## LOCKERS

05/99

## PART 1 GENERAL

## 1.1 SUBMITTALS

All items designated with a "G", including product literature, calculations, component data, certificates, diagrams, drawings, and samples shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-01 Data

Manufacturer's data; AE.

Submit manufacturer's data and written specifications on lockers.

## SD-04 Drawings

Drawings; AE.

Submit shop drawings showing layout, elevations and details of all lockers. Indicate materials and thickness.

## SD-14 SD Samples

Manufacturer's finishes; AE.

Submit actual color chips a minimum of of locker finish colors. Finish and color of all components shall match those specified in the drawings Interior Finish Materials Legend. Finish and color shall not be limited to manufacturer's standard finish selections but shall be standard or custom color as required to meet the project color requirements.

## 1.2 DELIVERY AND STORAGE

Deliver materials in manufacturer's original unopened containers. Provide blocking as required, store materials under cover and protect against damage.

## 1.3 SCHEDULING

Lockers shall not be assembled, installed and set in place until all interior room finishes and materials at the installation location have been applied or installed and are completely set or dry.

## PART 2 PRODUCTS

## 2.1 METAL LOCKERS (LK-1)

Lockers shall be double tiered in quantities and locations as shown on the drawings. Lockers shall be wardrobe storage type, equal to Republic Storage Systems Lockers, "Quiet" model. All major steel parts shall be fabricated from mild, cold rolled steel, free from imperfections and capable of taking a high grade enamel finish. Standard equipment shall include two single prong wall hooks attached with two bolts for each hook component located on the interior side wall of each locker. Finish shall be baked-on enamel. Overall dimensions for all metal lockers shall be: wide by deep. Single tier metal lockers shall be high. Double tier metal lockers shall be high.

## 2.1.1 Locker Body

All locker body components, tops, bottoms, sides, and backs shall be made of 24 gauge steel. Tops and bottoms shall have single flanges on all four sides. Backs shall be flanged on three sides. All nuts and bolts shall be zinc or cadmium plated.

## 2.1.1.1 Sloping Top

All two-tier locker units shall receive a continuous sloping top with slip joint splices, hip and valley ends and corners without exposed fasteners. All sloped top components shall be fabricated from 24 gauge steel.

## 2.1.2 Locker Doors

Door shall be 16 gauge steel, formed with a full channel shape on the lock bar side to fully conceal the lock bar, channel formation on the hinge side and right angle formations across the top and bottom. Locker doors shall include a minimum of 4 louver ventilation slots, top and bottom.

## 2.1.2.1 Locker Door Hinges

Provide two hinges for each door on the locker. Each hinge shall be 2 inches long, five knuckle tight pin type, securely welded to frame and secured to door with rivets.

## 2.1.2.2 Locker Door Latching Mechanism

Door latching device shall be a one-piece, pre-lubricated, spring steel latch completely contained within the lock bar, under tension, to provide rattle-free operation. The lock bar shall be pre-painted, double-channel steel construction. The lock bar shall be securely contained within the door channel by self-lubricating polyethylene guides that isolate the lock bar from metal-to-metal contact with the door. There shall be three latching points for lockers over in height and two latching points for all lockers under in height. The lock bar travel shall be limited by contacting resilient high-quality, elastomeric cushioning devices concealed inside the lock bar.

## 2.1.2.3 Recessed Handle

A non-protruding 14 gauge lifting trigger shall be provided for actuating the lock bar when opening the door. It shall be contained in a formed 20

gauge stainless steel pocket with exposed portion encased in molded ABS thermoplastic cover that provides isolation from metal to metal contact. The trigger shall be an integral part of the steel slide plate which transfers the lifting force to the lock bar. The stainless steel pocket shall contain a recessed mounting area for the various lock types available and also mounting for the number plate.

#### 2.1.2.4 Locker Door Number Plate

Each door shall have a polished aluminum number plate with black background and etched aluminum numerals not less than high. Plates shall be attached with pop rivets.

#### 2.1.3 Door Frames

Door frames shall be 16 gauge steel formed into deep face channel shapes with a continuous vertical door strike integral with the frame on both sides of the door opening. Cross frame members of 16 gauge channel shapes, including intermediate cross frame on double tier lockers shall be securely welded to vertical framing members to insure a square and rigid assembly.

##### 2.1.3.1 Frame Hooks/Silencers

Frame hooks to accept latching shall be of heavy gauge steel, set close in and welded to the door frame. Continuous vertical door strike shall protect frame hooks from door slam damage. A soft rubber silencer shall be provided and securely installed on each frame hook.

#### 2.1.4 Color

Locker colors shall match those indicated in the drawing Interior Finish Materials Legend and project colorboards.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Install lockers in areas indicated. Install in accordance with approved shop drawings and manufacturer's recommendations. Fasten lockers together and then to walls and built-up locker base with minimum of two fasteners per locker.

#### 3.2 CLEAN-UP

Upon completion of installation, clean all surfaces. Touch-up all scratches and marks with touch-up paint provided by locker manufacturer.

-- End of Section --

DIVISION 11 – EQUIPMENT

11000 Division 11: Equipment - Outline Specifications  
11601N Laboratory Equipment And Fumehoods

## SECTION 11000

DIVISION 11: EQUIPMENT - OUTLINE SPECIFICATIONS  
01/02

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

The contractor edited specification section shall include the material physical characteristics, performance, fabrication, and installation criteria listed below for each equipment item.

## 1.1.1 Source Selection

Casework elevations show reasonable equipment layout. They are not intended to limit selection. Verify needs and requirements with base authorities.

## 1.1.2 Mechanical and Electrical Connections

Equipment requiring mechanical and/or electrical connections shall be coordinated with the appropriate mechanical and electrical specifications and drawings to include specification Section 01016 MECHANICAL REQUIREMENTS, Section 15000, DIVISION 15000: MECHANICAL - OUTLINE SPECIFICATIONS, Section 01017, ELECTRICAL REQUIREMENTS, and Section 16000, DIVISION 16000, ELECTRICAL - OUTLINE SPECIFICATIONS.

## 1.1.3 Backflow Preventors

Backflow preventors shall be provided wherever the possibility a cross-connect or interconnect between a potable water supply and any source of non-potable water or other contaminant could result in contaminating the potable water. Backflow preventors shall be as specified in Section 15000: DIVISION 15400A, PLUMBING, GENERAL PURPOSE.

## 1.2 Contractor Furnished and Installed Equipment

The contractor will provide residential kitchen equipment indicated on the plans and herein, including all necessary utility requirements and connectors to include gas, water, waste and electricity.

## 1.2.1 Garbage Disposal Unit

Provide and install a garbage disposal unit for the sink in the POL Operations Center Break Area. Disposal will be 3/4 horsepower, continuous feed, 1800 RPM min., and provide stainless steel dual swivel impellers. GE Model No. GFC329G or equal.

## 1.2.3 Gas Range

Provide and install a 30" slide-in gas range in the POL Operations Center Break Area. Range will include a Porcelain-Enameled Cooktop, Sealed Cooktop Burner Design, Porcelain-Enameled Drip Pans, Electronic Pilotless Ignition System, Self-Cleaning Oven, Electronic Controls with Temperature Display, Electronic Clock and Timer, Porcelain-Enameled Broiler Pan, Two

Oven Racks, Oven Door with glass panel, and Large Removable Storage Drawer. GE Model No. JGSP23 or equal.

#### 1.3.7 Range Hood

Provide and install a 30" wide range hood in the POL Operations Center Break Area. Range hood will have a removable grease filter and be vented directly to the exterior of the building (provide backdraft protection). The fan will be four-speed and have a vertical/horizontal exhaust capacity of not less than 350 cfm. The sound level will not exceed 6 sones. GE Model No. JV635CWW or equal.

#### 1.3.8 Range Hood Fire Suppression System

Provide and install a fire extinguishing system in the range hood of the POL Operations Center. Must be a UL listed, dry system. Chemical storage containers will be concealed in the kitchen cabinets over the range hood, but must be readily accessible to maintenance personnel. Twenty First Century International Fire Equipment and Services Corp. Guardian 1, Model No. 1384-A or equal.

-- End of Section --

## SECTION 11601N

## LABORATORY EQUIPMENT AND FUMEHOODS

08/01

## 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 CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH-2092 (1992) Industrial Ventilation

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167 (1996) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A 366/A 366M (1997) Commercial Quality (CS) Steel, Carbon, (0.15 Maximum Percent) Cold-Rolled

ASTM B 221M (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

ASTM B 221 (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM C 1048 (1997; Rev. B) Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass

## CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)

CDC BMBL (1988) Biosafety in Microbiological and Biomedical Laboratories

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 45 (1996) Fire Protection for Laboratories Using Chemicals

NFPA 70 (1999) National Electrical Code

## UNDERWRITERS LABORATORIES (UL)

UL 586 (1996) High-Efficiency, Particulate, Air Filter Units

## 1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

Conform to provisions of Section 11700N, "General Requirements for Medical and Dental Equipment" and Section 12351N, "Medical and Dental Casework."

Provide final utility connections and utility service to equipment including waste, under Sections 15050N, "Basic Mechanical Materials and Methods"; 15400N, "Plumbing Systems"; 15217N, " Medical Gas and Vacuum Piping"; 16050N, "Basic Electrical Materials and Methods"; and 16402N, "Interior Distribution System."

### 1.3 SUBMITTALS

Submit the following in accordance with Section 01330, Submittal Procedures."

#### SD-02 Shop Drawings

Laboratory equipment and fume hood layout; G-ED

Laboratory equipment and hood schedules

#### SD-03 Product Data

Fumehood assembly; G

Radio isotope fumehood; G

Biological safety cabinet; G

Include descriptive literature, technical data sheets, and diagrams.

#### SD-04 Samples

Exterior hood paint; G

#### SD-06 Test Reports

Fumehood test; G

Base cabinet test; G

#### SD-08 Manufacturer's Instructions

Fumehood assembly

Radio isotope fumehood

Biological safety cabinet

#### SD-10 Operation and Maintenance Data

Fumehood assembly, Data Package 2; G

Radio isotope fumehood, Data Package 2; G

Biological safety cabinet, Data Package 2; G

Submit operation and maintenance data in accordance with Section 01781, "Operation and Maintenance Data."

### 1.4 SUBMITTAL REQUIREMENTS

#### 1.4.1 Hood Paint

Submit color chips of exterior hood paint. Submit [at least five] colors which are standard with the manufacturer.

#### 1.4.2 Drawing Requirements

Show pertinent installation layout. Indicate details of construction and rough-in requirements.

#### 1.4.3 Schedule

Include each type of equipment and hood and submit in accordance with Section 11700N, "General Requirements for Medical and Dental Equipment."

#### 1.4.4 Tests

Submit fumehood test [and] cabinet test reports required by ACGIH-2092.

### PART 2 PRODUCTS

#### 2.1 MATERIALS, COMPONENTS, AND SPECIAL DESIGN REQUIREMENTS

##### 2.1.1 Aluminum Alloy

ASTM B 221M equivalent in ultimate tensile, yield, and shear strengths to Alloy 6063-T5 or 6063-T6.

##### 2.1.2 Carbon Steel

ASTM A 366/A 366M, cold rolled sheets, commercial bright finish.

##### 2.1.3 Stainless Steel

ASTM A 167; No 4 satin finish including welds and fabricated surfaces. Provide Type 302, 304, or 316 alloy unless otherwise specified. Provide minimum thickness of 1.5 mm, except 1.8 mm thick for working surface.

##### 2.1.4 Safety Glass

ASTM C 1048, fully tempered "FT," clear.

##### 2.1.5 Casework Components

Conform with Section 12351N, "Medical and Dental Casework" for base cabinets, counter tops, service fittings and finishes.

##### 2.1.6 High Efficiency Particulate Air (HEPA) Filter

Meet requirements of UL 586.

##### 2.1.7 Fumehood Design

Design, calculate face velocities, and test fume hoods in accordance with ACGIH-2092, Laboratory fume hoods, auxiliary systems, and associated equipment shall meet the requirements of NFPA 70 and NFPA 45.

##### 2.1.8 Hood Static Pressure Loss

With the sash in full-open position the static pressure loss through the fumehood shall not exceed 13 mm water gage when operating at 23 mpm, 22 mm water gage at 30 mpm, 29 mm water gage at 38 mpm. For hoods equipped with bypass, the static pressure loss and exhaust volume shall remain relatively constant (within 5 percent) regardless of sash position.

#### 2.1.9 Electrical Devices

Prewired at the factory to a common, integral junction box to provide easy exterior connection and disconnection.

### 2.2 UNITS

2.2.1 Unit Fume hood shall be constant volume, auxiliary air configuration, enclosed unit mounted on base cabinet; exterior dimensions will be a maximum of 49 inches wide by 30 inches deep by approximately 96 inches high excluding base cabinet.

#### 2.2.1.1 Base Cabinet Portion of Assembly

Base cabinet shall be carbon steel to match other base cabinets located in the room. Cabinet will be modified to have a recessed apron containing electrical convenience outlets.

#### 2.2.2 [Enter Appropriate Subpart Title Here] 2.2.2.1 Hood Interior, Including Working Surface

Type 304 stainless steel, with interior vertical joints and intersections of vertical surface with working surface having an approximate radius. Provide working surface with a raised rim around all sides to prevent spillage from running out face of hood.

#### 2.2.2.2 Sash

Safety glass, minimum thickness, counterbalanced, vertical sliding type, Type 304 stainless steel frame.

#### 2.2.2.3 Baffle

Adjustable, with moving parts resistant to corrosion, removable for cleaning.

#### 2.2.2.4 Lighting Fixtures

Explosion proof, fluorescent, with cool white lamps and switch, providing on working area. Locate switch for fixture on exterior of hood frame, or in recess of base cabinet. Provide sealed safety glass window barrier between interior working and fixture spaces, and access for tube replacement exterior to hood interior working area.

#### 2.2.2.5 Service Fixtures

Provide remote controls for piped services and locate on hood exterior frame. Provide serrated supply ends with nozzles arranged close to sash, precluding the need of reaching to interior back of hood to make connections to outlets. Base metal of fixtures shall be brass. Protect metal fixtures inside hood with chemical resistant coating of clear plastic over polished chrome plate.

- a. Cold water: Remote controlled valve, with vacuum breaker; hood wall mounted gooseneck faucet with serrated nozzle. Arrange faucet parallel to hood wall and over cup sink.
- b. Gas, air and vacuum: Provide fixtures for each service, each fitting with remote controlled valve and supply end (inside hood) consisting of a serrated hose nozzle and escutcheon trim. Provide natural gas, air at 685 kPa, and vacuum at of HG.
- c. Acid waste: Recessed cup sink, or, fabricated of Type 316 stainless steel, 2 liter capacity. Furnish with acid waste p-trap and locate under water faucet, integral with countertop. Provide acid vent.
- d. Electrical convenience outlets: Two duplex, grounded, three-wire, 125 volt, 60 Hz, single phase, 20 ampere. Locate in recessed area of base cabinet or on side posts of hood. Provide stainless steel or chrome-plated cover plate. Provide 15 ampere circuit breaker protection.

#### 2.2.2.6 Blower Switch

Single-pole, 115-volt, 60-Hz, with pilot light. Locate switch in hood frame or in recess of base cabinet.

#### 2.2.2.7 Duct Stub

Collar size suitable for ductwork indicated. Finish of areas that may come in direct contact with fumes shall be same material and finish as hood interior.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Install units at locations indicated. Conform to installation provisions of Section 11700, "General Requirements for Medical and Dental Equipment" and utility installation provisions of Divisions 15 and 16 of this specification, and the ACGIH-2092 including provision for an adequate supply of tempered make-up air to meet the air flow requirements of fume hood. Provide interlocks for controls and alarms to maintain the required air balance between hood interiors and the room.

#### 3.2 [Enter Appropriate Subpart Title Here] 3.3 FIELD QUALITY CONTROL

##### 3.3.1 Inspection

Examine each unit for visual defects, operation and conformance to specifications.

##### 3.3.2 Tests

Test each unit to ensure that the equipment is operational and conforms to specification requirements. Field tests for fume hood operation and performance shall meet the requirements of ACGIH-2092.

-- End of Section --

DIVISION 12 – FURNISHINGS

12000	Division 12: Furnishings - Outline Specifications
12690	Entrance Mats
12705	Furniture Systems

## SECTION 12000

DIVISION 12: FURNISHINGS - OUTLINE SPECIFICATIONS  
01/02

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

## 1.1.1 Guide Specifications

The contractor shall edit and provide the following UFGS guide specifications for Division 12: Furnishings:

Section 12350A, CASEWORK FOR MEDICAL AND DENTAL FACILITIES  
(LABORATORIES)

Section 12490A, WINDOWCOVERINGS

## 1.1.2 Government Edited Specifications

The contractor shall incorporate the following government-supplied, fully edited specification sections as part of the project design:

Section 12690, ENTRANCE MATS

## 1.2 REFERENCES

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

## FEDERAL SPECIFICATIONS

FS AA-V-00200 (Rev B) Venetian Blinds

## 1.3 SECTION 12350A, CASEWORK FOR MEDICAL AND DENTAL FACILITIES

The contractor shall edit this specification for use in specifying the metal laboratory casework required for this project. Product shall be equal to LOC Scientific Laboratory Systems modular metal cabinets.

## 1.3.1 Material and Performance Criteria

The contractor edited specification section shall include the following material physical characteristics and performance criteria:

- A. All components shall be fabricated from steel. All components shall be a minimum of 20 gauge steel.
- B. All surfaces shall be painted with chemically-resistant baked on epoxy powder.
- C. Hinges shall be concealed type with 165-170 degree swing, self-closing, nickel plated and shall be independently adjustable.

D. Drawer and door pulls shall be solid ABS recessed black plastic.

E. Components shall include matching base, wall cabinets and spacer panels.

#### 1.3.2 Installation Criteria

The metal laboratory cabinets shall include the following fabrication and installation requirements:

A. Door and drawer heads shall be "double pan" construction and sound deadened.

B. Backs shall be removable.

#### 1.4 SECTION 12490A, WINDOWCOVERINGS

The contractor edited specification section shall include the following material physical characteristics and performance criteria:

##### 1.4.1 General Description and Requirements

All exterior windows shall receive window blinds. Additionally, Refueler Maintenance Facility Office interior windows will receive blinds. Window blind type shall be horizontal "mini" blinds conforming to FS AA-V-00200, Type II, equal in design and performance to HUNTER DOUGLAS CONTRACT model CD80.

##### 1.4.2 Material and Performance Criteria

The window blinds shall include the following minimum requirements:

A. All components shall be metal with the exception of braided ladders.

B. Individual component requirements shall be as follows:

1) Head Channel. Shall be constructed of corrosion-resistant steel and formed in a U-shape with rolled edges designed to eliminate the need for a valance. All hardware shall be enclosed within the head channel.

2) Bottom Rail. Shall be constructed of steel, corrosion-resistant, with baked on polyester paint. Bottom rail shall be formed with a double-lock seam into a closed oval shape with matching end caps.

3) Slats. Shall be thick aluminum alloy 6011 heat treated and spring tempered, wide. Slats shall be painted with a solid color which shall include an anti-static property to repel dust.

4) Controls. Shall include tilt and lift controls including mechanism to prevent over-tightening. Control location and design shall be such that prevents unauthorized use by children

5) Braided Ladders. Shall be composed of 100 percent polyester yarn. Spacing shall be a maximum of and spaced to provide a minimum 15.2 slats per drop. Spacing shall provide a uniform overlap of slats when in the closed position.

C. All components shall match in color.

1.4.3 Installation Criteria

The window blinds shall include the following installation requirements:

A. All blinds shall be an "inside" mount style within the window frame opening.

-- End of Section --

## SECTION 12690

## ENTRANCE MATS

05/99

## PART 1 GENERAL

## 1.1 SUBMITTALS

All items designated with a "G", including product literature, calculations, component data, certificates, diagrams, drawings, and samples shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-01 DATA

Finishes; AE.

Accessory Items; AE.

Manufacturer's descriptive data and catalog cuts indicating materials of construction, and installation requirements.

## SD-04 Drawings

Entrance Mats; AE.

Shop drawings showing layout, details, special cuts, and sections.

## SD-14 Samples

Finishes; AE.

One typical section or piece of the product at least by showing proposed colors and finishes to include vinyl edging.

## 1.2 PRODUCT DELIVERY, STORAGE AND HANDLING

Deliver products in manufacturer's packing with labels intact. Store undercover and protect against damage.

## PART 2 PRODUCTS

## 2.1 MATERIALS

Entrance mat shall be a "free-lay", surface mounted rail type with interlocking integrated ball/socket connections between rails to facilitate roll back and cleaning. Specifications and construction shall be equal to Construction Specialties, Inc. "Pedimat" surface mounted model no. M1-M-HC-AL. Assembly shall include an aluminum block-out frame.

### 2.1.1 Entrance Mat

Tread rails shall be constructed of black high-impact vinyl/acrylic tread rails complete with co-extruded soft-durometer cushions. Exposed hinge rail connectors shall be extruded 60603-T6 mill finish aluminum complete with perforations for drainage. Heavy-duty carpet tread inserts to be 100% solution-dyed 6,6 nylon with a 12 mil monofilament insert for extra abrasiveness. Each carpet fiber and monofilament shall be fusion-bonded to a rigid two-ply backing to prevent fraying and supplied in continuous splice-free lengths. Carpet insert color shall be as noted on the drawings.

#### 2.1.1.1 Durability Testing

The manufacturer shall provide testing results, either by in-house or national testing method which quantifies the durability of the mat. Test method shall be comparable to testing with a rolling load.

### 2.1.2 Mat Perimeter Component

The entrance mat shall include a perimeter aluminum block-out frame to form the transition from entrance mat to the surrounding porcelain tile flooring. The frame shall be deep composed of 6063-T6 aluminum alloy with wide exposed surface.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Provide entrance mat assembly to areas and to dimensions as indicated on the drawings. Installation of entrance mat shall be free-lay to allow for removal and cleaning of sub-floor. Installation shall include latex leveling screed by installer to ensure level base for the aluminum frame. Black vinyl fillers shall be furnished where standard tread spacing cannot be maintained.

#### 3.1.1 Entrance Mat Extent

Entrance mat shall be to dimensions and locations as shown on the drawings. Mat shall extend from door opening to door opening within the vestibule and shall abut porcelain floor tile which parallels the side walls of the vestibule.

-- End of Section --

DIVISION 13 – SPECIAL CONSTRUCTION

13000  
13219N

Division 13: Special Construction-Outline Specifications  
Cleaning Petroleum Storage Tanks

SECTION 13000

DIVISION 13: SPECIAL CONSTRUCTION-OUTLINE SPECIFICATIONS  
11/98

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

The contractor shall edit and provide the following UFGS guide specifications for Division 13. All Part 3 requirements shall be included and unedited for all equipment included in this contract.

Section 13110A, CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)

1.1.1 General Requirements

A. No special requirements other than those indicated in section 01017.

PART 2 NOT APPLICABLE

PART 3 NOT APPLICABLE  
-- End of Section --

DIVISION 14 – CONVEYING SYSTEMS

NOT APPLICABLE

DIVISION 15 – MECHANICAL

15000

Division 15: Mechanical - Outline Specifications

## SECTION 15000

DIVISION 15: MECHANICAL - OUTLINE SPECIFICATIONS  
01/02

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

## 1.1.1 Contractor Edited Guide Specifications

Government provided UNIFIED FACILITIES GUIDE SPECIFICATIONS (UFSG) shall be completely edited and fully coordinated with the drawings to accurately and clearly identify the product and installation requirements for the facility. The provided specifications define the minimum requirements for items of equipment, materials, installation, training, operating and maintenance instructions, O&M manuals and testing that shall be provided for the facility. The contractor shall edit and provide the following UFSG guide specifications for Division 15: Mechanical:

SECTION 15070A, SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT

SECTION 15080A, THERMAL INSULATION FOR MECHANICAL SYSTEMS

SECTION 15182A, REFRIGERANT PIPING

SECTION 15190A, GAS PIPING SYSTEMS

SECTION 15400A, PLUMBING, GENERAL PURPOSE

SECTION 15566A, WARM AIR HEATING SYSTEMS

SECTION 15569A, WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20  
MBTUH

Deleted section

SECTION 15700A, UNITARY HEATING AND COOLING EQUIPMENT

SECTION 15895A, AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST  
SYSTEM

SECTION 15951, DDC CONTROLS

SECTION 15990A, TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS

SECTION 15995A, COMMISSIONING OF HVAC SYSTEMS

## 1.1.1.1 References

All references that have been deleted from the body of the guide specification shall be delete from the general paragraph which defines the reference.

## 1.1.1.2 Standard Products

Material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall be essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. The label or listing of the Underwriters Laboratories, Inc., will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this label or listing, a statement from a nationally recognized, adequately equipped testing agency indicating that the items have been tested in accordance with required procedures and that the materials and equipment comply with all contract requirements will be accepted.

#### 1.1.1.3 Electrical Work

Electrical motor-driven equipment specified herein shall be provided complete with motors. Motors shall conform to the requirements of Section 16415 ELECTRICAL WORK, INTERIOR. Motor starters and disconnect switches shall be provided and installed for all motors under Section 16415A, ELECTRICAL WORK, INTERIOR. When available, starters and disconnect switches may be provided integral with the equipment from the factory. All equipment electrical data of voltage, phase and power requirements shall be fully coordinated with the plans and specifications.

#### 1.1.1.4 Submittals

All submittals listed in the guide specifications shall be submitted to the designer for approval. All items to be submitted, including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal.

Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. Furthermore, a copy(s) of the reviewed submittal shall be provided to the government for information and/or acceptance.

#### 1.1.1.5 Regulatory Requirements

All regulatory requirements contained out in the guide specification shall be retained in the contractor edited project specification.

#### 1.1.1.6 Guide Specification Requirements

All products, equipment, systems and materials specified in Section 01016, MECHANICAL REQUIREMENTS shall be as specified in the applicable UNIFIED FACILITIES GUIDE SPECIFICATIONS (UFSG) listed above. The specifications shall be edited in accordance with the designer notes associated with each specification. Editing of the specific material and installation requirements shall be limited to these choices called out within the designer's notes except as indicated below.

#### 1.1.1.7 Non-Applicable Mechanical Equipment and Systems

Specific products and items of equipment identified in the provided specifications but not required for the facility shall be edited out. All products, equipment and systems specified UNIFIED FACILITIES GUIDE SPECIFICATIONS (UFSG) listed above but not specified in Section 01016, MECHANICAL REQUIREMENTS shall be deleted from the contractor edited specification section.

#### 1.1.1.8 Additional Requirements

All additional requirements for products, equipment, systems and materials specified in Section 01016, MECHANICAL REQUIREMENTS that exceed or conflict with the applicable UNIFIED FACILITIES GUIDE SPECIFICATIONS (UFSG) listed above shall be as specified in Section 01016, MECHANICAL REQUIREMENTS.

#### 1.1.1.9 Items Without Government Guide Specification

Where products, items of equipment, materials, installation, training, operating and maintenance instructions, O&M manuals or testing requirements are not specified in the guide specifications, special Sections within each applicable guide specification shall be prepared to specify those items. All of the additional requirements for the equipment, systems and materials specified in Section 01016, MECHANICAL REQUIREMENTS shall be incorporated into the special Sections within each applicable guide specification shall be prepared to specify those items.

#### 1.1.2 Deleted Paragraph

### 1.2 REFERENCES

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

#### AMERICAN GAS ASSOCIATION (AGA)

AGA Manual (1994; Addenda/Correction Jan 1996) A.G.A.  
Plastic Pipe Manual for Gas Service

#### AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 1010 (1994) Self-Contained, Mechanically Refrigerated Drinking-Water Coolers

ARI 700 (1999) Specifications for Fluorocarbon and Other Refrigerants

ARI 710 (1995) Liquid-Line Driers

ARI 720 (1997) Refrigerant Access Valves and Hose Connectors

ARI 750 (1994) Thermostatic Refrigerant Expansion Valves

ARI 760 (1994) Solenoid Valves for Use With Volatile Refrigerants

#### AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.10.1 (1998; Z21.10.1a; Z21.10.1b; Z21.10.1c)  
Gas Water Heaters Vol. I, Storage Water

Heaters with Input Ratings of 75,000 Btu  
Per Hour or Less

ANSI Z21.10.3	(1998) Gas Water Heaters Vol.III, Storage Water Heaters With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous Water Heaters
ANSI Z21.22	(1999) Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems
ANSI Z21.45	(1995) Flexible Connectors of Other Than All-Metal Construction for Gas Appliances
ANSI Z21.56	(1994; Z21.56a) Gas-Fired Pool Heaters
ANSI Z21.69	(1999) Connectors for Movable Gas Appliances
ANSI Z358.1	(1998) Emergency Eyewash and Shower Equipment

## AMERICAN PETROLEUM INSTITUTE (API)

API Spec 6D	(1994; Supple 1 Jun 1996; Supple 2 Dec 1997) Pipeline Valves (Gate, Plug, Ball, and Check Valves)
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AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING  
ENGINEERS (ASHRAE)

ASHRAE 15	(1994) Safety Code for Mechanical Refrigeration
ASHRAE 17	(1998) Method of Testing for Capacity Rating of Thermostatic Refrigerant Expansion Valves
ASHRAE 34	(1997) Number Designation and Safety Classification of Refrigerants
ASHRAE 90.1	(1989; 90.1b; 90.1c; 90.1d; 90.1e; 90.1g; 90.1i; 90.1l-1995; 90.1m-1995; 90.1n-1997) Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings

## AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1001	(1990) Pipe Applied Atmospheric Type Vacuum Breakers
ASSE 1002	(1986) Water Closet Flush Tank Ball Cocks
ASSE 1003	(1995) Water Pressure Reducing Valves for Domestic Water Supply Systems
ASSE 1005	(1986) Water Heater Drain Valves - 3/4-Inch Iron Pipe Size

ASSE 1006	(1989) Residential Use (Household) Dishwashers
ASSE 1011	(1995) Hose Connection Vacuum Breakers
ASSE 1012	(1995) Backflow Preventers with Intermediate Atmospheric Vent
ASSE 1013	(1999) Reduced Pressure Principle Backflow Preventers
ASSE 1018	(1986) Trap Seal Primer Valves Water Supply Fed
ASSE 1020	(1998) Pressure Vacuum Breaker Assembly (Recommended for Outdoor Usage)
ASSE 1037	(1990; Rev thru Mar 1990) Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 105/A 105M	(2001) Carbon Steel Forgings for Piping Applications
ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 183	(1998) Carbon Steel Track Bolts and Nuts
ASTM A 193/A 193M	(2001a) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 334/A 334M	(1999) Seamless and Welded Carbon and Alloy-Steel Tubes for Low-Temperature Service
ASTM A 47/A 47M	(1999) Ferritic Malleable Iron Castings
ASTM A 515/A 515M	(1989; R 1997) Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A 516/A 516M	(1990; R 1996) Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A 518/A 518M	(1999) Corrosion-Resistant High-Silicon Iron Castings
ASTM A 53/A 53M	(2001) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 536	(1984; R 1999e1) Ductile Iron Castings

ASTM A 539	(1999) Electric-Resistance-Welded Coiled Steel Tubing for Gas and Fuel Oil Lines
ASTM A 580/A 580M	(1998) Stainless Steel Wire
ASTM A 653/A 653M	(2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 733	(1999) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A 74	(1998) Cast Iron Soil Pipe and Fittings
ASTM A 888	(1998e1) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B 111	(1998) Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock
ASTM B 111M	(1998) Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock (Metric)
ASTM B 117	(1997) Operating Salt Spray (Fog) Apparatus
ASTM B 152	(1997a) Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B 152M	(1997a) Copper Sheet, Strip, Plate, and Rolled Bar (Metric)
ASTM B 209	(2000) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(2000) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 210	(2000) Aluminum and Aluminum-Alloy Drawn Seamless Tubes
ASTM B 210M	(2000) Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric)
ASTM B 241/B 241M	(2000) Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B 280	(1999) Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM B 306	(1999) Copper Drainage Tube (DWV)
ASTM B 32	(1996) Solder Metal
ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM B 42	(1998) Seamless Copper Pipe, Standard Sizes

ASTM B 43	(1998) Seamless Red Brass Pipe, Standard Sizes
ASTM B 584	(2000a) Copper Alloy Sand Castings for General Applications
ASTM B 62	(1993) Composition Bronze or Ounce Metal Castings
ASTM B 75	(1999) Seamless Copper Tube
ASTM B 75M	(1999) Seamless Copper Tube (Metric)
ASTM B 813	(2000) Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM B 828	(2000) Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM B 88	(1999) Seamless Copper Water Tube
ASTM B 88M	(1999) Seamless Copper Water Tube (Metric)
ASTM C 1053	(2000) Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications
ASTM C 1126	(1998) Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation
ASTM C 1136	(1995) Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 1290	(1995) Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts
ASTM C 195	(1995) Mineral Fiber Thermal Insulating Cement
ASTM C 449/C 449M	(1995) Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C 518	(1998) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 533	(1995) Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 534	(1999) Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 547	(1995) Mineral Fiber Pipe Insulation

ASTM C 552	(2000) Cellular Glass Thermal Insulation
ASTM C 553	(1999) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 564	(1997) Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C 591	(1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 610	(1999) Molded Expanded Perlite Block and Pipe Thermal Insulation
ASTM C 612	(2000) Mineral Fiber Block and Board Thermal Insulation
ASTM C 647	(1995) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM C 665	(1998) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 795	(1992; R 1998e1) Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C 916	(1985; R 1996e1) Adhesives for Duct Thermal Insulation
ASTM C 920	(1998) Elastomeric Joint Sealants
ASTM C 921	(1989; R 1996) Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM D 1004	(1994; Rev. A) Initial Tear Resistance of Plastic Film and Sheeting
ASTM D 1248	(2000) Polyethylene Plastics Molding and Extrusion Materials
ASTM D 1785	(1999) Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2000	(1999) Rubber Products in Automotive Applications
ASTM D 2235	(1996a) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D 2239	(1999) Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
ASTM D 2241	(2000) Poly(Vinyl Chloride) (PVC)

## Pressure-Rated Pipe (SDR Series)

ASTM D 2447	(1999) Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1999) Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2485	(1991; R 1996) Evaluating Coatings for High Temperature Service
ASTM D 2513	(2000) Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
ASTM D 2517	(2000) Reinforced Epoxy Resin Gas Pressure Pipe and Fittings
ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2657	(1997) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D 2661	(1997ael) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2665	(2000) Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2672	(1996a) Joints for IPS PVC Pipe Using Solvent Cement
ASTM D 2683	(1998) Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D 2737	(1999) Polyethylene (PE) Plastic Tubing
ASTM D 2822	(1991; R 1997el) Asphalt Roof Cement
ASTM D 2846/D 2846M	(1999) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D 2855	(1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 2996	(1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe

ASTM D 3035 (1995) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter

ASTM D 3122 (1995) Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings

ASTM D 3138 (1995) Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components

ASTM D 3139 (1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

ASTM D 3212 (1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

ASTM D 3261 (1997) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

ASTM D 3308 (1997) PTFE Resin Skived Tape

ASTM D 3311 (1994) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns

ASTM D 4060 (1995) Abrasion Resistance of Organic Coatings by the Taber Abraser

ASTM D 4101 (2000) Propylene Plastic Injection and Extrusion Materials

ASTM D 4551 (1996) Poly(Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane

ASTM D 520 (2000) Zinc Dust Pigment

ASTM D 638 (1997) Tensile Properties of Plastics

ASTM D 638M (1998) Tensile Properties of Plastics (Metric)(Withdrawn 1998; no replacement)

ASTM E 1 (1998) ASTM Thermometers

ASTM E 84 (2000a) Surface Burning Characteristics of Building Materials

ASTM E 96 (2000) Water Vapor Transmission of Materials

ASTM F 1290 (1998a) Electrofusion Joining Polyolefin Pipe and Fittings

ASTM F 1760 (1997) Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having

## Reprocessed-Recycled Content

ASTM F 409	(1999a) Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings
ASTM F 437	(1999) Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 438	(1999) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F 439	(1999) Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F 441/F 441M	(1999) Chlorinated Poly(Vinyl Chloride).(CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F 442/F 442M	(1999) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 493	(1997) Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F 628	(2000) Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core
ASTM F 877	(2001) Crosslinked Polyethylene (PEX) Plastic Hot- and Cold- Water Distribution Systems
ASTM F 891	(2000) Coextruded Poly (Vinyl chloride) (PVC) Plastic Pipe with a Cellular Core

## AMERICAN WATER WORKS ASSOCIATION(AWWA)

AWWA B300	(1999) Hypochlorites
AWWA B301	(1992; Addenda B301a - 1999) Liquid Chlorine
AWWA C105	(1999) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C203	(1997; Addenda C203a - 1999) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(1997) Grooved and Shouldered Joints

AWWA C700	(1995) Cold-Water Meters - Displacement Type, Bronze Main Case
AWWA C701	(1988) Cold-Water Meters - Turbine Type, for Customer Service
AWWA D100	(1996) Welded Steel Tanks for Water Storage
AWWA EWW	(1999) Standard Methods for the Examination of Water and Wastewater
AWWA M20	(1973) Manual: Water Chlorination Principles and Practices

## AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	(1992) Filler Metals for Brazing and Braze Welding
AWS B2.2	(1991) Brazing Procedure and Performance Qualification
AWS Brazing Hdbk	(1991) Brazing Handbook
AWS D1.1	(2000) Structural Welding Code - Steel
AWS Z49.1	(1999) Safety in Welding and Cutting

## ASME INTERNATIONAL (ASME)

ASME A112.1.2	(1991; R 1998) Air Gaps in Plumbing Systems
ASME A112.14.1	(1975; R 1998) Backwater Valves
ASME A112.18.1M	(1996) Plumbing Fixture Fittings
ASME A112.19.1M	(1994; R 1999) Enameled Cast Iron Plumbing Fixtures
ASME A112.19.2M	(1998) Vitreous China Plumbing Fixtures
ASME A112.19.3M	(1987; R 1996) Stainless Steel Plumbing Fixtures (Designed for Residential Use)
ASME A112.19.4M	(1994; Errata Nov 1996) Porcelain Enameled Formed Steel Plumbing Fixtures
ASME A112.21.1M	(1991; R 1998) Floor Drains
ASME A112.21.2M	(1983) Roof Drains
ASME A112.36.2M	(1991; R 1998) Cleanouts
ASME A112.6.1M	(1997) Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)

ASME B16.11 (1996) Forged Fittings, Socket-Welding and Threaded

ASME B16.12 (1998) Cast Iron Threaded Drainage Fittings

ASME B16.15 (1985; R 1994) Cast Bronze Threaded Fittings Classes 125 and 250

ASME B16.18 (1984; R 1994) Cast Copper Alloy Solder Joint Pressure Fittings

ASME B16.21 (1992) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.22 (1995; B16.22a1998) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B16.23 (1992; Errata Jan 1994) Cast Copper Alloy Solder Joint Drainage Fittings - DWV

ASME B16.24 (1991; R 1998) Cast Copper Alloy Pipe Flanges, Class 150, 300, 400, 600, 900, 1500, and 2500, and Flanged Fittings, Class 150 and 300

ASME B16.26 (1988) Cast Copper Alloy Fittings for Flared Copper Tubes

ASME B16.29 (1994) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV

ASME B16.3 (1998) Malleable Iron Threaded Fittings

ASME B16.33 (1990) Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (Sizes 1/2 through 2

ASME B16.34 (1997) Valves - Flanged, Threaded, and Welding End

ASME B16.39 (1998) Malleable Iron Threaded Pipe Unions Classes 150, 250, and 300

ASME B16.4 (1998) Gray Iron Threaded Fittings

ASME B16.5 (1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24

ASME B16.9 (1993) Factory-Made Wrought Steel Buttwelding Fittings

ASME B31.1 (1998) Power Piping

ASME B31.2 (1968) Fuel Gas Piping

ASME B31.5 (1992; B31.5a1994) Refrigeration Piping

ASME B31.9 (1996) Building Services Piping

ASME B36.10M (1996) Welded and Seamless Wrought Steel Pipe

ASME B40.1 (1991) Gauges - Pressure Indicating Dial Type - Elastic Element

ASME BPVC SEC IX (1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

ASME BPVC SEC VIII D1 (1998) Boiler and Pressure Vessel Code; Section VIII, Pressure Vessels Division 1 - Basic Coverage

ASME CSD-1 (1998) Controls and Safety Devices for Automatically Fired Boilers

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301 (1997) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

CISPI 310 (1997) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

CISPI HSN-85 (1985) Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA Tube Handbook (1995) Copper Tube Handbook

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

FCCCHR-CCC (1993) Manual of Cross-Connection Control

HYDRAULIC INSTITUTE (HI)

HI 1.1-1.5 (1994) Centrifugal Pumps

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

IAPMO Z124.1 (1995) Plastic Bathtub Units

IAPMO Z124.3 (1995) Plastic Lavatories

IAPMO Z124.5 (1997) Plastic Toilet (Water Closets) Seats

IAPMO Z124.9 (1994) Plastic Urinal Fixtures

INTERNATIONAL CODE COUNCIL (ICC)

CABO A117.1 (1998) Accessible and Usable Buildings and

## Facilities

ICC Plumbing Code	(2000)International Plumbing Code (IPA)
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-110	(1996) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
MSS SP-25	(1998) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-44	(1996) Steel Pipe line Flanges
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-67	(1995) Butterfly Valves
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
MSS SP-70	(1998) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(1997) Gray Iron Swing Check Valves, Flanges and Threaded Ends
MSS SP-72	(1999) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-73	(1991; R 1996) Brazing Joints for Copper and Copper Alloy Pressure Fittings
MSS SP-78	(1998) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	(1995) Class 3000 Steel Pipe Unions Socket-Welding and Threaded
MSS SP-85	(1994) Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)	
MICA Insulation Stds	(1993) National Commercial & Industrial Insulation Standards
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)	
NEMA 250	(1997) Enclosures for Electrical Equipment (1000 Volts Maximum)
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	

NFPA 31 (1997; TIA 97-1) Installation of Oil Burning Equipment

NFPA 54 (1999) National Fuel Gas Code

NFPA 70 (1999) National Electrical Code

NFPA 90A (1999) Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF 14 (1999) Plastics Piping Components and Related Materials

NSF 3 (1996) Commercial Spray-Type Dishwashing and Glasswashing Machines

NSF 5 (1992) Water Heaters, Hot Water Supply Boilers, and Heat Recovery Equipment

NSF 61 (1999) Drinking Water System Components - Health Effects (Sections 1-9)

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA-01 (1998) Plastic Pipe in Fire Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI G 101 (1996) Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data

PDI WH 201 (1992) Water Hammer Arresters

PLUMBING-HEATING-COOLING CONTRACTORS NATIONAL ASSOCIATION (NAPHCC)

NAPHCC Plumbing Code (1996) National Standard Plumbing Code

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

SMACNA Seismic Restraint Mnl (1998) Seismic Restraint Manual Guidelines for Mechanical Systems

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J 1508 (1997) Hose Clamps

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 5 (1994) White Metal Blast Cleaning

SSPC SP 6 (1994) Commercial Blast Cleaning

U.S. ARMY CORPS OF ENGINEERS (USACE)

TI 809-04	(1998) Seismic Design for Buildings
U.S. GENERAL SERVICES ADMINISTRATION (GSA)	
CID A-A-240	(Rev A; Canc. Notice 1) Shower Head, Ball Joint
CID A-A-50012	(Basic) Garbage Disposal Machine, Commercial
U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)	
10 CFR 430	Energy Conservation Program for Consumer Products
21 CFR 175	Indirect Food Additives: Adhesives and Components of Coatings
PL 93-523	(1974; Amended 1986) Safe Drinking Water Act
UNDERWRITERS LABORATORIES (UL)	
UL 174	(1996; Rev thru Oct 1999) Household Electric Storage Tank Water Heaters
UL 430	(1994; Rev thru Nov 1996) Waste Disposers
UL 732	(1995; Rev thru Jan 1999) Oil-Fired Storage Tank Water Heaters
UL 749	(1997; Rev thru Feb 1999) Household Dishwashers
UL 921	(1996) Commercial Electric Dishwashers
UL Gas&Oil Dir	(1999) Gas and Oil Equipment Directory

### 1.3 SECTION 15070A, SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT

The contractor edited specification section shall include seismic protection measures for all mechanical equipment and systems as required by TI 809-04 Seismic Design for Buildings. Structural requirements shall be in accordance with Section 01015 STRUCTURAL REQUIREMENTS and Section 13080A SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT.

#### 1.3.1 Sway Brace Location Plan

A separate sway brace location plan shall not be submitted under this Section. Sway brace locations for ductwork and piping shall be shown on the respective shop or fabrication drawing submittals for ductwork and piping which are required in other DIVISION 15 Sections.

#### 1.3.2 Seismic Sway braces Requirements

Seismic sway braces shall be provided at intervals as required in the guide specification. One brace shall be provided for each interval. Where a duct or pipe segment is shorter than the required bracing interval, at least one sway brace shall be provided for that segment. Attachments to equipment

shall not be considered acceptable pipe sway braces.

#### 1.4 SECTION 15080A, THERMAL INSULATION FOR MECHANICAL SYSTEMS

The contractor edited specification section shall include the following material physical characteristics and performance criteria for field-applied insulation and accessories on mechanical systems shall be as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated.

##### 1.4.1 Identification of Materials

Add the following to the subject paragraph; Insulation materials shall be delivered in the manufacturer's unopened containers. Materials shall remain in the manufacturer's unopened containers until actual use and shall not be transferred to any other containers.

##### 1.4.2 Delete Acoustical Lining Insulation Adhesive

Acoustical lining and/or acoustical lining insulation adhesive shall not be provided as part of this project. Delete this paragraph from the project specifications.

##### 1.4.3 Pipe Insulation

All pressure piping shall be insulated as specified in the guide specification for the service intended. All exceptions to the requirement for insulation, which may be contained within the guide specification, shall be deleted except for piping passing through a fire rated surface when required for fire stopping purposes.

##### 1.4.4 Insulation Covers

Provide reusable insulation covers at all check valves, control valves, strainers, filters, or any other piping component requiring access for routine maintenance. Insulation exposed to the weather or possible physical damage shall be covered by an aluminum metal jacket. All piping with metal jacket shall be identified on the drawings.

##### 1.4.5 Dual Temperature Piping

There shall be no dual temperature piping within this project. Delete all paragraphs related to dual temperature piping from the project specifications.

##### 1.4.6 Delete Flexible Elastomeric Cellular Insulation

The use of Flexible Elastomeric Cellular Insulation:ASTM C 534, Type I or II on cold water pipes and equipment shall not be promitted. The use of Flexible Elastomeric Cellular Insulation:ASTM C 534, Type I or II in thicknesses greater than 15 mm shall not be promitted.

##### 1.4.7 Delete Contact Adhesive

Contact adhesive is used only with flexible cellular insulation. Since flexible cellular insulation shall not be used, delete this paragraph.

##### 1.4.8 Supply and Outside Air Ductwork Insulation

All supply and outside air ductwork shall be insulated as specified in the guide specification for the service intended. All exceptions to the requirement for insulation, which may be contained within the guide specification, shall be deleted except for ductwork passing through a fire rated surface when required for fire stopping purposes.

#### 1.4.9 Return and Exhaust Air Ductwork Insulation

All return and exhaust ductwork shall be insulated as specified in the guide specification for the service intended whenever the ductwork enters a space that is not conditioned to the exact heating and cooling setpoint as the space the duct serves. All exceptions to the requirement for insulation, which may be contained within the guide specification, shall be deleted except for ductwork passing through a fire rated surface when required for fire stopping purposes.

#### 1.4.10 Deleted paragraph

#### 1.4.11 Rectangular Duct Exposed to Weather

The top surface of rectangular duct exposed to weather must have a minimum pitch of not less than 1 inch per linear foot. The flat surface shall not be subject to ponding water.

#### 1.5 SECTION 15182A, REFRIGERANT PIPING

This guide specification covers the requirements for refrigerant piping. The contractor shall edited this specification section if split type direct expansion systems are supplied. All field installed refrigerant piping shall conform to the material physical characteristics, performance criteria and installation requirements found in the guide specification.

#### 1.6 SECTION 15190A, GAS PIPING SYSTEMS

This guide specification covers the requirements for low pressure gas systems conforming to NFPA 5/ANSI Z223.14 for nonindustrial uses.

##### 1.6.1 Material Criteria

Interior piping shall be black steel. The contractor edited specification section shall include the material physical characteristics and performance criteria for Steel Pipe, Joints, and Fittings. Aluminum Alloy Pipe and Tubing, Joints, and Fittings; Copper Tubing, Joints and Fittings; Steel Tubing, Joints and Fittings; Thermoplastic Pipe, Tubing, Joints, and Fittings; and Fiberglass Pipe, Joints, and Fittings shall be deleted from the project specifications.

##### 1.6.2 Piping in Partitions

Concealed piping shall be located in hollow partitions only. Piping shall not be located in solid or cellular masonry walls or solid partitions. Tubing passing through walls or partitions shall be protected against physical damage.

##### 1.6.3 Anodeless Riser

Connections between aboveground metallic and underground plastic piping

shall be made only outside, underground, and with approved anodeless riser type transition fitting.

#### 1.6.4 Delete Underground Metallic Pipe

Buried metallic piping shall not be provided. Underground distribution piping shall be polyethylene as specified in Section 02556A GAS DISTRIBUTION SYSTEM. Delete all references to buried metallic piping from the project gas specifications.

#### 1.6.5 Piping Buried Under Buildings

Underground piping shall not be installed beneath buildings. Delete this paragraph in the guide specification from the project specification.

### 1.7 SECTION 15400A, PLUMBING, GENERAL PURPOSE

This guide specification covers general purpose type plumbing systems. This specification essentially implements the requirements of the International Plumbing Code (IPC). Equipment supports and connections, for either equipment on the ground or in the building, will conform to these requirements.

#### 1.7.1 Domestic Water Service Meter

Domestic water meter shall be as specified in Section 02510A, WATER DISTRIBUTION SYSTEM or Section 15400A, PLUMBING, GENERAL PURPOSE. Coordinate with the project Civil Engineer.

##### 1.7.1.1 Maximum Water Pressure Drop

The following sentence, which limits the maximum water pressure drop through the meter, shall be added to the project specifications; Maximum pressure drop through the meter shall be [\_\_\_] kPa at a flowrate of [\_\_\_] L/s. The values of flowrate and pressure drop within the brackets shall be coordinated with the design of the plumbing system.

##### 1.7.1.2 Meter Boxes

When exterior water meters are provided or specified, the specification for meter boxes shall be added to the project specifications; Meter boxes shall be of cast iron or concrete of sufficient size to completely enclose the meter and shut-off valve or service stop. Box height shall extend from invert of the meter to final grade at the meter location. Cover shall be cast iron with the word "WATER" cast in it.

#### 1.7.2 Piping Material Criteria

The Tables at the end of the specification shall be edited to indicate which materials shall be used for installation of each system. The contractor edited specification section shall include the following material physical characteristics and performance criteria for piping systems:

##### 1.7.2.1 Domestic Pressure Piping

Materials for domestic hot and cold water distribution systems shall be copper aboveground and copper type k underground. Underground domestic piping shall be limited to building service entrance and exits to exterior

drinking fountains. All piping 2 inch and smaller shall be soldered using 95/5 tin antimony solder, piping 2 1/2 inch and larger shall be brazed. Multi-flame torch is not required for soldering or brazing. TABLE II shall be edited to indicate which materials shall be used for installation of each system.

#### 1.7.2.2 Wall Hydrants

Coordinate the terminology "wall hydrants" and "freeze-proof wall hydrants" between the drawings and the specifications. All exterior wall hydrants shall be of the freeze-proof type. Show the elevation of wall hydrants on the plans or add the following sentence to this paragraph; Wall hydrants shall be installed 600 mm above finished grade.

#### 1.7.2.3 Wall Faucets

Coordinate the terminology "wall faucets" and "hose bibbs" between the drawings and the specifications. Show the elevation of wall faucets on the plans or add the following sentence to this paragraph; wall faucets shall be installed 600 mm above finished grade.

#### 1.7.2.4 Soil, Waste, Drain, and Vent Piping

Materials for above/below ground soil, waste, and vent shall be as specified in Table I in CEGS Section 15400A PLUMBING, GENERAL. All building underslab piping elevations should be shown on the drawings. Verify that the pipe elevations do not conflict with building structural footings and foundations walls.

#### 1.7.2.5 Pipe Cleanouts

Sanitary plans shall show sufficient cleanouts for system maintenance. Cleanouts shall be provided at all turns and at least every 15 m along straight runs.

#### 1.7.2.6 Identification of Piping

All exposed and concealed piping in accessible spaces shall be identified in accordance with the requirements of UFGS Section 09900A, PAINTING, GENERAL.

#### 1.7.3 Fixtures

Plumbing fixtures, faucets and trim shall be as specified in the guide specification except as specifically modified in Section 01014, INTERIOR DESIGN.

#### 1.7.4 Escutcheons

Escutcheons are not generally available in satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy as specified in Section 15400A, PLUMBING, GENERAL PURPOSE. Escutcheons shall be chromium plated steel escutcheons only.

#### 1.7.5 Structural Interference

All building underslab piping elevations shall be shown on the drawings. The contractor shall verify that the pipe elevations do not conflict with

building structural footings and foundations walls before any building structural footings and foundations walls are formed.

#### 1.7.6 EPDM Roof Requirements

Pipes, which pass through EPDM roof material shall be flashed watertight in accordance with the recommendations and details of the EPDM roof manufacturer.

#### 1.8 SECTION 15569A, WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH

This guide specification covers the requirements for packaged hot water and steam boiler systems (gas fired) of up to 6000 kW output capacity as required in Section 01016, MECHANICAL REQUIREMENTS. The hot water boiler and piping systems operate at water temperatures below 120 degrees C and water working pressures less than 1100 kPa. This guide specification also covers the requirements for packaged hot water and steam boiler systems (oil or combination oil/gas fired) of up to 6000 kW output capacity. All references to steam and to fuel types other than natural gas shall be deleted from the project specifications.

##### 1.8.1 High and Medium Temperature Water Systems

All heating systems contain in this project have been limited to low temperature water heating or low pressure steam systems. Delete are specifications for high and medium temperature water systems.

##### 1.8.2 Boilers

Delete water tube boilers. Delete cast iron boilers.

###### 1.8.2.1 Condensing Boiler

Condensing boilers shall be in the form of fire tube boilers with pulse combustion. Delete copper fire tube type boilers and multiple heat exchanger type boilers from the project specifications.

###### 1.8.2.2 Hydronic Boiler Modular Configuration

Hydronic boilers shall be of the modular, condensing type.

###### 1.8.2.3 Hot Water Boilers

Hot water boilers shall be specified for space heating. All blanks shall be completed by the designer to comply with Section 01016, MECHANICAL REQUIREMENTS.

###### 1.8.2.4 Deleted Paragraph

##### 1.8.3 Fuel Burning Equipment

Include all the required data for proper design of the boiler. Delete all references to fuel oils and combination gas and oil fired units which shall not be used.

###### 1.8.3.1 Gas Pulse Combustion Burners and Controls

Burners shall be an integral part of the boiler module heat exchanger and require no pilot. Burner shall operate on the pulse combustion principle, shall be self-aspirating and require no forced-draft or induced-draft fan to supply air for combustion after ignition. Burner control shall be on/off operative type. Burner shall be provided complete with fuel supply system. Gas fired units shall conform to UL 795. Pulse combustion chamber and fire tubes shall be constructed of stainless steel.

#### 1.8.3.2 Combustion Control Equipment for Package Equipment

Each boiler shall be equipped with a factory wired control panel. Control systems and safety devices for automatically fired boilers shall conform to ASME CSD-1 and shall be UL listed. Electrical combustion and safety controls shall be rated at 120 volts, single phase, 60 Hz and shall be connected as specified in Section 16415 ELECTRICAL WORK, INTERIOR. Indicating lights shall be provided on the control panel. A red light shall indicate flame failure, and a green light shall indicate that the main fuel valve is open. Panel for each boiler shall be integral to the unit. The following shutdown conditions shall require manual reset before the boiler can automatically recycle:

- a. Flame failure.
- b. Blocked combustion air intake.
- c. Insufficient prepurge air.
- d. Low-water cutoff.
- e. High temperature cutoff.

#### 1.8.3.3 Boiler Control DDC Panel for Multiple Boiler Sequencing

The boiler control DDC panel shall be as specified in Section 15971, DIRECT DIGITAL HVAC CONTROL SYSTEMS.

#### 1.8.4 Deleted Paragraph

#### 1.8.5 Continuous Emissions Monitoring

Delete this paragraph for pulse boilers.

#### 1.8.6 Conventional Breeching and Stacks

Delete this paragraph for condensing boilers.

#### 1.8.7 Foundation (Setting) Materials

Delete this paragraph for condensing boilers.

#### 1.8.8 FUEL OIL STORAGE SYSTEM

Delete this paragraph for condensing boilers.

#### 1.8.9 Pipe Expansion

Expansion loops and offsets shall provide adequate expansion of the main straight runs of the system within the stress limits specified in ASME B31.1. The loops and offsets shall be cold-sprung and installed where required. Pipe guides and anchors shall be provided as required. The designer shall show the location loops, offsets, pipe guides and anchors on the project drawings. When pipe expansion cannot be handled through

offsets and loops, than justification shall be provided. When pipe expansion can be handled through offsets and loops, than expansion joints shall be deleted from the project specification.

#### 1.8.10 Hot Water Piping

Deleted sentence.

##### 1.8.10.1 Pipe Materials

All new heating water piping within the facility shall be black steel conforming to ASTM A53, Schedule 40 or copper.

##### 1.8.10.2 Pipe Joints

HVAC water piping installed within the facility shall utilize threaded joints or welded joints. Welded joints and fittings shall be used for joints 65 mm and larger. Copper pipe joints 65 mm and larger shall be brazed.

##### 1.8.10.3 Grooved Mechanical Joints

Grooved mechanical pipe joints and fittings shall only be installed in accessible locations.

##### 1.8.10.4 Connections to Equipment

Connections to equipment shall utilize unions for pipe 2 inch and smaller and flanges for pipe 2 1/2 inch and larger.

#### 1.8.11 Pumps

Delete all pump except as listed below:

##### 1.8.11.1 HVAC Water Circulating Pumps

The HVAC water shall be circulated by base mounted, end-suction, centrifugal pumps with mechanical seals. Required flow rate and head loss shall be corrected for glycol. The pumps shall be non-overloading allowing the pump to operate at any point on its characteristic curve. Each pump shall be provided with a calibrated bronze balancing valve.

##### 1.8.11.2 Deleted Paragraph

#### 1.8.12 Steam Traps

All steam traps shall be of the float-and-thermostatic type. Delete all other types of steam traps from the guide specification.

#### 1.8.13 FUEL OIL SYSTEM

Delete this paragraph for condensing boilers.

#### 1.9 Deleted Paragraph

#### 1.10 SECTION 15700A, UNITARY HEATING AND COOLING EQUIPMENT

This guide specification includes tailoring options for room unit, package

systems, split system, and air-conditioners, heat pumps, and accessories.

1.10.1 Blower Speed

When the blower has multiple speeds, than the units shall be selected to provide the scheduled coil capacity supply air volume while operating on medium blower speed.

1.10.2 Sound Power Levels

Unit sound power levels, dB referenced to the 10 to the minus twelfth power watt, at the fan operating speed selected to meet specified capacity shall not exceed the following values in each octave band at mid-frequency:

MAXIMUM SOUND POWER LEVELS dB

Unit Capacity in CFM	Octave Band/Mid-frequency				
	3/250	4/500	5/1000	6/2000	7/4000
200	54	54	51	42	36
300	60	56	55	45	39
400	60	55	51	45	39
600	64	60	57	48	41
800	61	59	58	48	41
1000	60	60	59	48	42
1200	62	60	59	50	44

1.10.3 Multi-circuit Air-to-Refrigerant Coils for POL Operations Facility

Direct expansion (DX) coil located in furnace for POL Operations facility and multizone air handler for Refueler Maintenance Facility (RMF) with associated air cooled condensing unit, shall contain at least two compressors and refrigerant circuits with hot gas bypass on lead circuit. Coils shall have copper or aluminum tubes of 10 mm (3/8 inch) minimum diameter with copper or aluminum fins that are mechanically bonded or soldered to the tubes. Casing shall be galvanized steel or aluminum. Contact of dissimilar metals shall be avoided. Coils shall be tested in accordance with ASHRAE 15 at the factory and be suitable for the working pressure of the installed system. Each coil shall be dehydrated and sealed after testing and prior to evaluation and charging. Each unit shall be provided with a factory operating charge of refrigerant and oil or a holding charge. Unit shipped with a holding charge shall be field charged. Separate expansion devices shall be provided for each compressor circuit.

1.10.4 Heating Source

Electric heat shall not be provided.

1.11 SECTION 15566A, WARM AIR HEATING

This guide specification covers the requirements for gas fired furnaces. The contractor shall edit this specification section if split type direct expansion systems are supplied. All field installed refrigerant piping shall conform to the material physical characteristics, performance criteria and installation requirements found in the guide specification.

1.12 Modulating Gas-Control Valve for Burner, Maxitrol or Equal

For the POL Operations building furnace, the gas-control valve shall be Maxitrol type or equal, 2.5:1 turndown ratio (valve can modulate to 40% of maximum), electronic, discharge air control set at 60 degrees F. A room override shall provide 40 degrees F increase in discharge air temperature in response from a 24 volt room thermostat.

#### 1.13 Stainless Steel Gas Burner Heat Exchanger

For Refueler Maintenance Facility furnace, the gas burner heat exchanger shall be stainless steel welded construction with capable of 100 degree F temperature rise.

#### 1.14 SECTION 15895A, AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM

This guide specification covers the requirements for air supply, distribution, ventilation, air systems equipment, air handling units and exhaust portion of an HVAC system as required in Section 01016, MECHANICAL REQUIREMENTS.

##### 1.14.1 Standard Products

Add the following requirements to this paragraph in the project specification: "All products used in the air supply and distribution system shall be appropriate for the intended purpose and suitable for the pressures and temperatures encountered."

##### 1.14.2 PIPING COMPONENTS

The material and installation specifications for piping components shall be deleted from this specification. Add the following sentence in place of both the material and installation specifications for piping components; Piping and piping components for both the hot and chilled water systems shall be as specified for hot water systems in Section 15569A, WATER AND STEAM HEATING; OIL, GAS OR BOTH; UP TO 20 MBTUH.

##### 1.14.3 CONTROLS

Controls shall be provided as specified in Section 15951 DDC CONTROLS FOR HVAC CONTROL SYSTEMS.

##### 1.14.4 DUCTWORK COMPONENTS

The following modifications shall be made to the project specification;

###### 1.14.4.1 Metal Ductwork

Seal Class A shall be specified for all ductwork regardless of the static pressure class. Delete the following references to seal class C and to static pressure class from the project specification; "Static pressure Class 125, 250, and 500 Pa (1/2, 1, and 2 inch w.g.) ductwork shall meet the requirements of Seal Class C. Class 750 through 2500 Pa (3 through 10 inch) shall meet the requirements of Seal Class A."

###### 1.14.4.2 Deleted Paragraph

#### 1.14.4.3 Fibrous Glass Ductwork

Rectangular fibrous glass ductwork in accordance with NAIMA AH115 shall not be provided. Delete this paragraph.

#### 1.14.4.4 Splitters and Manual Balancing Dampers

Splitters dampers shall not be provided. Manual balancing dampers shall be provided at each branch duct and runout. Modify this paragraph in the project specification to delete all references to splitter type dampers.

#### 1.14.4.5 Outdoor Air Intake Ducts and Plenums

Add the following paragraph to the project specifications; "Outside air intake ducts and plenums shall be fabricated with watertight soldered or brazed joints and seams and insulated as specified in Section 15080A, THERMAL INSULATION FOR MECHANICAL SYSTEMS. The plenum shall be provided with a drain at the low point. The drain shall be ran to the nearest floor drain located in a non-finished area."

#### 1.14.4.6 Acoustical Duct Liner

Delete this paragraph type from the specification. Duct liner shall not be provided. Delete all referneces to duct liner from the project specification.

#### 1.14.4.7 Diffusers, Registers, and Grilles

Add the following sentence to the project specifications; "Fastener used to secure units should be of the same material as the diffuser, register or grilled to prevent galvanic corrosion."

#### 1.14.4.8 Air Vents, Penthouses, and Goosenecks

Goosenecks necks shall not be provided. Except for exhaust fans serving cooking equipment, air penetrations through the roof shall be provided with a penthouses. Air vents and goosenecks shall be edited from the project specifications.

#### 1.14.5 AIR SYSTEMS EQUIPMENT

The following modifications shall be made to the project specification;

##### 1.14.5.1 In-Line Centrifugal Fans

Delete the following sentence from the project specifications; "Fans shall be mounted in a welded tubular casing." If fan is to be mounted above the ceiling, the fan as specified in the project specifications shall fit in the space above the ceiling. The paragraph as written requires a welded tubular fan housing, which typically requires 24" minimum to install. A square in-line fan with a much lower profile shall be provided when space is tight, but the following paragraph must be edited to specify this type of in-line fan.

##### 1.14.5.2 Power Roof Ventilators

Except for plumbing vents, boiler vents, exhaust fans serving cooking equipment, and louvered intake penthouses, with motorized dampers at the exterior, no other mechanical equipment shall be located on the roof of the

facility. The project specifications shall be modified to specify power roof ventilators to kitchen fans only. Those portions that do not apply shall be deleted from the project specifications.

#### 1.14.5.3 Fan Sheave

The following sentence shall be added to the project specification for all fans, either individual or within air handling equipment; "A replacement sheave shall be provided during system test, adjust and balance if required to achieve system air balance."

#### 1.14.5.4 Heating and Cooling Coils

All heating and cooling coils shall be water type coils. All other coil types shall be deleted from the project specifications.

#### 1.14.5.5 Water Coils

Add the following sentence to the project specifications; "Coil fins shall be spaced at a maximum of 395 fins per meter."

#### 1.14.5.6 Air Filters

At a minimum all filters, except those in kitchen hoods, shall be 50 mm (2 inch) depth, sectional, disposable type of the size indicated and shall have an average efficiency of 25 to 30 percent when tested according to ASHRAE 52.1. Filter types not provided shall be deleted from the project specifications.

#### 1.14.6 AIR HANDLING UNITS

All Air Handling Units shall be fabricated in a factory. Units shall be single-zone draw-through type or multizone blow-through two deck type as specified in Section 01016, MECHANICAL REQUIREMENTS. Units shall include fans, coils, airtight insulated casing, prefilters for pre cooling coils in the outside air path, filter sections in the mixed air path, adjustable V-belt drives, belt guards for externally mounted motors, access sections where indicated, combination sectional filter-mixing box, drysteam humidifier, vibration-isolators, and appurtenances required for specified operation. Air handling unit shall have published ratings based on tests performed according to ARI 430.

##### 1.14.6.1 Casings

The first two sentences of this paragraph shall be edited as follows; "Casing sections shall be of the double wall type, constructed of a minimum 18 gauge galvanized steel, or 18 gauge steel outer casing protected with a corrosion resistant paint finish according to paragraph FACTORY PAINTING. Inner casing of double-wall units shall be minimum 1.0 mm (20 gauge) solid galvanized steel." The option for "A minimum 200 mm by 200 mm sealed glass window suitable for the intended application shall be installed in all access doors." shall be included in the project specifications when ever the air handling unit is large enough to walk into and close the access doors. Interior door handles shall also be provided in these large units.

##### 1.14.6.2 Cooling Coils, Spray Type

Spray type coils shall be deleted from the project specifications.

1.14.6.3 Deleted Paragraph1.14.6.4 Deleted Paragraph.1.14.6.5 Delete Paragraph.

## 1.14.7 TERMINAL UNITS

Delete this paragraph from the project specification.

## 1.14.8 INSTALLATION

Add the following sentence to this paragraph; "The entire air supply and distribution system, including ductwork, dampers, air supply equipment, plenums and all other associated components shall be installed to meet the requirements of NFPA 90A."

## 1.14.9 Underground Ductwork

No ductwork shall be installed underground. Delete this paragraph from the project specification.

## 1.14.10 Exposed Ductwork

Add the following sentence to this paragraph; "Ductwork shall not be installed exposed without the approval of the contracting officer's representative except for kitchen exhaust ductwork."

## 1.14.11 Concealed Ducts Conveying Moisture Laden Air

## 1.14.11.1 FRP Ductwork

FRP Ductwork may be added to this paragraph providing the air stream is within the temperature limits of the material as stated in the manufacture's published literature.

1.14.11.2 Deleted Paragraph

## 1.15 SECTION 15990A, TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS

This guide specification covers the requirements for the testing, adjusting, and balancing (TAB) of all heating, ventilating and air conditioning systems. The Designer shall actively participate in the process, including review of all submittals contained herein and participation in TAB verification.

## 1.16 SECTION 15995A, COMMISSIONING OF HVAC SYSTEMS

This guide specification covers the requirements for commissioning of HVAC systems. Each mechanical system and piece of equipment shall be commissioned. A properly functioning HVAC system assures a comfortable, healthy and productive environment for the user. The contractor's mechanical designer shall be a member of the HVAC commissioning team, and

shall actively participate in the process, including review of all submittals contained herein. The checklists provided in the guide specification are to be used as guides for the preparation of project checklists. The appropriate checklist shall be included in the project specification for each HVAC equipment component. The designer will add additional checklists for equipment or systems not included in this guide specification or modify the checklists where necessary for specific project requirements. If, for example, a system needs to be tested with certain internal load, each appropriate checklist should be modified to include this requirement along with specifics on how load should be generated.

PART 2 NOT USED

PART 3 NOT USED

-- End of Section --

DIVISION 16 – ELECTRICAL

16000

Division 16: Electrical - Outline Specifications

## SECTION 16000

## DIVISION 16: ELECTRICAL - OUTLINE SPECIFICATIONS

## PART 1 GENERAL

## 1.1 GENERAL REQUIREMENTS

## 1.1.1 Guide Specifications

The contractor shall edit and provide the following UFGS guide specifications for Division 16, Electrical. All Part 3 requirements shall be included and unedited for all equipment included in this contract.

Section 16070A, SEISMIC PROTECTION FOR ELECTRICAL EQUIPMENT

Section 16375A, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND

Section 16415A, ELECTRICAL WORK, INTERIOR

Section 16528A, EXTERIOR LIGHTING

Section 16710A, PREMISE DISTRIBUTION SYSTEM

Section 16711A, TELEPHONE SYSTEM OUTSIDE PLANT

Section 16713N, FIBER OPTIC CABLE OUTSIDE PLANT

Section 16721A, INTERCOMMUNICATION SYSTEM

Section 16751A, CLOSED CIRCUIT TELEVISION SYSTEMS

Section 16770, RADIO AND PUBLIC ADDRESS SYSTEMS

## 1.2 SECTION 16070, SEISMIC BRACING FOR ELECTRICAL EQUIPMENT

## 1.2.1 Material Criteria

This section should be edited to conform to the seismic requirements for this area.

## 1.3 SECTION 16375, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND

## 1.3.1 General Requirements

A. Pad mounted transformer shall be delta/wye, dead front, loop feed, surge arresters, with oil immersed current limiting fuses with load break switch.

B. Primary cable shall be shielded, 15KV with 133% insulation. Cable insulation shall be EPR with minimum conductor size #2. Neutral cable shall be 600 volts.

- C. All primary connections shall be load break type.
- D. Ducts shall be 2-103mm concrete encased type EB ducts.
- E. All cabinets shall be provided with padlock hasp.

1.4 SECTION 16415, ELECTRICAL WORK, INTERIOR

1.4.1 General Requirements

- A. All conductors shall be copper.
- B. Conduits shall be EMT in concealed areas. Surface mounted IMC & cast boxes shall be used for conduit rough-in in trainer buildings.
- C. All interior branch circuit wiring shall be THHN/THWN.
- D. Light Fixtures shall meet requirements of COE light fixture details identified in Section 01017.
- E. All bus in panelboards shall be copper.
- F. Transient voltage surge suppression be incorporated into the main panel and shall meet the requirements of IEEE C62.41 and be UL listed in accordance with the testing requirements of UL1449.
- G. All step down transformers shall be compliant with NEMA TP-1.

1.5 SECTION 16528, EXTERIOR LIGHTING

1.5.1 General Requirements

- A. All exterior lighting shall meet the requirements of COE light fixture details identified in Section 01017.

1.6 SECTION 16710, PREMISE DISTRIBUTION SYSTEM

1.6.1 General Requirements

- A. Cable tray shall be basket type.
- B. Cables shall be plenum rated where required.
- C. Contractor shall have a minimum of 3 years experience in the application, installation and testing of the specified systems and equipment.
- D. All supervisors and installers assigned to the installation of this system or any of its components shall have factory certification from each equipment manufacturer that they are qualified to install and test the provided products.
- E. All installers assigned to the installation of this system or any of its components shall have a minimum of 3 years experience in the

installation of the specified copper and fiber optic cable and components.

F. Electrical boxes for telecommunication outlets shall be 117 mm square by 53 mm deep with minimum 9 mm deep single or two gang plaster ring as shown. Provide a minimum 27 mm conduit. Surface mounted IMC & cast boxes shall be used for conduit rough-in in trainer buildings.

1.7 SECTION 16711, TELEPHONE SYSTEM, OUTSIDE PLANT

1.7.1 General Requirements

- A. Cable shall be sized as indicated in Section 01017.
- B. Coil 4.5 meters of cable in each handhole for future splicing.
- C. Outside plant copper cables shall be terminated on 110 block.

1.8 SECTION 16713, FIBER OPTIC SYSTEM OUTSIDE PLANT

1.8.1 General Requirements

- A. Fiber optic cable shall be provided as indicated in section 01017.
- B. Coil 15 meters of cable in each handhole for future splicing.
- C. Single mode fiber shall be loose tube fiber with 6 fibers per tube.

1.9 SECTION 16721A, INTERCOMMUNICATION SYSTEM

1.9.1 General Requirements

- A. No special requirements other than those indicated in Section 01017.

1.10 SECTION 16751A CLOSED CIRCUIT TELEVISION SYSTEMS

1.10.1 General Requirements

- A. No special requirements other than those indicated in Section 01017.

1.11 SECTION 16770, RADIO & PUBLIC ADDRESS SYSTEMS

No special requirements. Location of devices shall be determined during the design of the project.

PART 2 NOT APPLICABLE

PART 3 NOT APPLICABLE

-- End of Section --

